GEOLOGICAL SURVEY

OF

ALABAMA.

EUGENE ALLEN SMITH, PH. D., STATE GEOLOGIST.

BULLETIN NO. 1. VOL V.

LIST OF THE FRESH-WATER AND MARINE CRUSTACEA OF ALABAMA, WITH DESCRIPTIONS OF THE NEW SPECIES AND SYNOPTICAL KEYS FOR IDENTIFICATION.

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INTRODUCTION.

The following pages are chiefly the result of a few days' collecting excursion in Mobile bay and vicinity and, of course, give but a very partial idea of the fauna of the littoral zone of the Gulf of Mexico. It is much to be regretted that a careful study of the fauna of the gulf is not now possible. The crustacea especially, if exhaustively studied, would be expected to afford answers to many interesting biological questions. Enough is even now known to stimulate curiosity and afford some valuable clues. There have been found several genera new to science, one of which finds its nearest affinity in an Australian species, but unexpected agreements are often quite as instructive as new varieties. Alabama is remarkably rich in novelties in her fresh-water carcinological fauna, despite the rather conspicuous poverty of material.

A great deal of attention is just now being given to the careful elaboration of local faunæ, notably of isolated or peculiarly situated bodies of water. Such investigations, if carried on in the comparative spirit, are powerful aids to the intelligent comprehension of those natural laws most directly involved in the correct elucidation of the development and differentiation of animal and vegetable life. And many times the simpler structure and less complex conditions found in lowly and inconspicuous groups of organisms afford just the opportunity needed to deduce principles whose practical application is found in the higher and economically valuable groups. Nor is the possibility of securing results of direct economic importance excluded at the beginning of such an investigation, as has often been demonstrated. A very simple illustration is found in the occurrence of the embryonic stages of parasitic worms in the micro-crustacea of pools and rivers in Alabama, not to mention the fact that similar minute crustacea afford the essential food supply of the fry of many food fishes. Should this paper serve to stimulate students to cultivate this interesting field by directing attention to the sources of information and the nature of the material, he will be abundantly repaid for the annoyance of the most trying excursion yet attempted. The fresh and salt waters of Alabama are inhabited by numerous species of nine orders of crustacea, as follows:

The *Ostracoda* or shelled crustacea, are survivers of one of the oldest groups, occurring abundantly in lower Palæozoic strata, and preserve much of the primitive simplicity of structure. These animals are rarely of conspicuous size, appearing more frequently as mere animated specks, and are found in marshy or oozy situations, especially in small pools and estuaries. The ocean is the home of a great number of species some of which are of considerable size. Mobile bay furnishes the largest species yet found in America. This is, however, a member of the strictly fresh-water genus *Cypris*. The great depths of the ocean contain their own representatives of this order.

The *Cladocera* are likewise minute bivalved crustacea, but in this case only the thorax

and abdomen are thus enclosed and the carapace is always very delicate and transparent. The order is essentially confined to fresh-water and the few marine forms are monstrosities In spite of the extreme delicacy of the organization of these animals, they are among the most abundant denizens of quiet bodies of water. Like plant-lice and a few other insects the cladocera are parthenogenetic and frequently pass through a sort of alternation of generations, the final stage of which is sexual and produces resting eggs, commonly protected by a case or ephippium, produced by the modification of the valves of the shell of the parent. This order and the Phyllopoda are best adapted of all crustacea for illustration of many important physiological and anatomical facts.

The *Copepoda* are microscopic crustacea even more abundant than either of the above-mentioned orders both in inland and pelagic situations. They may be recognized by the elongated multi-articulate body terminating with two stylets and furnished with cylindrical setose pairs of limbs attached to the thoracic segments beneath. The female generally bears the eggs in a pouch below the abdomen. Alabama has added her quota to the knowledge of this group also. Various species occur in almost incredible numbers in the waters of the gulf, while it is impossible to secure a gathering from pond or river not peopled by one or more species of the fresh-water genus Cyclops.

The *Phyllopoda* are larger than the animals of any of the previously mentioned orders and curiously mimic in some cases the Ostracoda or Cladocera and in others the Copepoda. From any of these all species are easily recognized by the many (from 10 to 20 pairs of) foliaceous swimming feet. The shell-less species are often very beautiful and are especially interesting because of the fickleness of their appearance and equally sudden disappearance. The eggs of many species will only germinate after a period of dessication and then the young seem to fall with the rain, as tadpoles are popularly thought to do, so rapidly do they develop.

In the waters of the gulf a few representatives of the *Cirrepedia* or barnacles may be found. These acorn-shells, long supposed to be mollusks, and at one time seriously regarded as a stage in the development of water-fowl, may be collected upon the piers and rocks along the shore.

Passing now to the higher crustacea or Mallacostraca (as distinguished from the already mentioned, often collectively called Entomostraca,) we find examples of the following orders: Order *Amphipoda* contains laterally compressed and rather small species of fourteen-footed crustacea, illustrated by the sand-fleas so abundant along shore and recognized by their enormous leaps. Order *Isopoda* resembles the above and like it has sessile eyes, but the body is depressed and many species are adapted (as the sow-bugs) for terrestrial habitation. Among the ten-footed or Decapod crustacea the order *Macrura* is illustrated by the cray-fish and shrimp, while the crabs of various species contute the order *Brachyura*.

The student in using this list is requested to turn first to the key at the end of the paper, by means of which any group here described may be identified by use of the key and the references to pages in the body of the paper. The key will not apply to species not contained in the list and is largely artificial. For means of more careful study the student must have recourse to special memoirs such as the following:

The various publications of the United States Fish Commission illustrate the most characteristic species of the higher orders. Dr Packard's monograph in Hayden's Twelfth Geological Report covers the Phyllopoda. Various papers by Birge and Forbes, and the writers' monograph in the twelfth annual of the Minnesota Geological survey, elucidate the fresh-water Entomostraca. The American Cirripedia still await elaboration as well as the marine Copepoda and most of the Ostracoda.

ORDER COPEPODA.

The minute animals which constitute this order are nearest like the extinct *Eurypteridæ* of Carboniferous times, but never attain the size of these archetypal crustacea. They are essentially active, natatory creatures, swimming by means of long, many-jointed antennæ, but also provided with at least four pairs of functional legs and a fifth pair generally modified to support the egg-sacs or to function in the act of fertilization. In the male the antennæ and often the feet are hinged or dactylate, for prehension. Although, as above indicated, the majority of the order are free-swimming and very active, a considerable number have adapted their structure to a parasitic life upon the gills of fishes or other crustacea, while still others are strangely modified in accommodation to the conditions of abysmal or limous situations. No group of microscopic organisms is more generally available or interesting for study. Without repeating general structural descriptions to be found in special monographs, we may simply notice that the non-parasitic division or *gnathostoma* fall naturally into six families, of which four have been noted in Alabama, as well as representatives of two families in the *Pœcilostoma* or semi-parasitic group.

FAMILY CALANIDÆ.

This family is typically pelagic, the whole structure being adapted to a life in open bodies of water, as seen in the slender natatory form, long antennæ, and graceful movements. The species are found in great numbers in the open seas, from the equator to the poles and the geographical range of many species is enormous. There are, however, a few genera to be found in inland or littoral locations, but generally these bear evidence of being out of their habitat in the compacted or stunted body and appendages. The females of this family carry the eggs in sacs beneath the body and the young are hatched as curious, six-limbed nauplii of oval form, which are at once exceedingly active. Body consisting of from ten to twelve (obvious) segments; abdomen slender, bearing two cylindrical stylets; anterior antennæ, with twenty-five segments, as long at least as the thorax; antennules bi-ramose, inner ramus multi-articulate; mandibles with seven to eight teeth and furnished with a bi-ramose palp; second maxillipeds long, many-jointed, directed forward, armed with a brush of strong setæ; first four pairs of feet bi-ramose, typically with three segments in each ramus; fifth pair frequently very different, sexually functional; ova enclosed in a single sac beneath the abdomen. The principal genera

are Calanus, Eucalanus, Rhincalanus, Heterochæta, Leuckartia, Undina, Scolecithrix, Euchæta, Calanoides, Aetidius, Drepanopus, Phyllopus, Temora, Temorella, Centropages, Candace, Acartia, Pseudodiaptomus, Diaptomus, Limnocalanus, Osphranticum, Epischura, Heterocope, Corynura, Calanopia, Pontellopsis, Parapontella, Pontella, Anomalocera.

GENUS CALANUS, Leach.

Cetochilus, Claus, Etc.

Cephalothorax slender, six-jointed, cervical suture generally present, antennæ 25-jointed, slender, alike in both sexes, except that in the male there are club-shaped appendages to the segments; posterior maxilliped elongate, composed of two thickened and lobed basal and five setose terminal joints; feet, five pairs, similar, bi-ramose, each ramus three-jointed; abdomen in the male five-, in the female four-jointed. The species of this genus are among the more slender of the family, the antennæ especially being elongated and graceful.

Calanus americanus, *sp. n* (?)

(Cf. C. longiremis, Claus.)

(Plate I, Fig. 9.)

Our knowledge of this species is insufficient to permit a satisfactory description. In most points which can be compared with the meagre description of *G. longiremis*, there is close agreement. The body is very slender and the joints of the antennæ are very narrow, reaching beyond the caudal setæ. The head is marked by a slight cervical suture. The abdomen has but three obvious segments in the female, probably the faint line of union between the third and fourth was overlooked. First abdominal segment very prominent anteriorly in the female, spinulous above; caudal stylets rather long for the genus, median seta greatly enlongated, exceeding entire abdomen. The antennæ bear long spines upon the apical and antipenult joints; antennules with the apical segment of two-jointed branch, 10-setose, median portion of inner ramus 8-articulate, terminal segment with three setæ; anterior maxilliped with extremely long thorny setæ on the apical segment, three median lobes, each with two strong setæ, basal lobe with four; second maxilliped with two lower segments elongate, the basal with three setose lobes, second segment with five setæ, five lobes of terminal portion rather short, with small setæ; both branches of the five pairs of feet three-jointed, terminal spine long, serrate, and curved.

The above description may serve to identify an animal certainly abundant in the Gulf and among the most beautiul and graceful of the Copepoda. None of the species hitherto found in the Atlantic seem to at all agree with the present form.

GENUS ACARTIA, Dana (=Dias, Lillg.)

Body slender, especially the anterior segment of the thorax, which is obliquely subtruncate in front; abdomen in the male five-jointed, the fourth joint being generally very inconspicuous, in the female three-jointed; antennæ not very long, twenty-jointed, nodose and in the male slightly modified; outer ramus of the antennule long and three-jointed; labrum three-lobed; mandiblar palp rather small; maxillæ with many hooked setæ; maxilliped as in Pontella; feet with inner rami two-jointed, outer three-jointed; fifth feet one-branched, in the female very small, bearing two setæ, in the male prehensile.

This genus was originally instituted by Dana, for four species somewhat like Pontella, but, as the descriptions were of necessity rather meager and the limits of the genus remained uncertain, a related form was found by Lillgeborg, in the North Sea, and called *Dias longiremis*. This name, therefore, became generally recognized, but, as Giesbrecht has shown, the specific application of later authors proves erroneous. The species of this genus at present recognizable are *A. longiremis*, North Sea, *A. bifilosus*, North Sea and Mediterranean, *A. discaudatus*, Giesbrecht, North Sea, *A. laxa*, Dana, Phillipene Ids., Atlantic Ocean, *A. denticormis* ,Brady (=? *A. limpida*, Dana,) Sandwich and Phillipene Ids.

Acartia gracilis, *sp. n.*

Dias longiremis ? HERRICK, Twelfth Ann. Rep. State Geologist of Minnesota. 1884.

The identification above quoted rested upon the correctness of Claus' identification. He seems, however, to have figured *A. bifilosus*, Gies, which is much more closely allied to our form.

Body very slender for the genus, the anterior segment particularly long and much narrowed anteriorly; abdomen very short; posterior segment of thorax rounded; abdomen in the male five-jointed, but with the fourth segment often obscured, last segment ornamented with spines, stylets about as wide as long, bearing five sub-equal setæ; antennæ twenty-jointed, extending to the last thoracic segment, very heavily spined; feet and mouth-parts with the usual characters; fifth feet of the female as in *A. bifilosis*, spermatophore as in *A. longiremis*.

The material was unfortunately insufficient for a complete characterization so that we are forced to resort to negative characters. The body is more slender than either A. longiremis or A. bifilosus. From A. discaudatus it differs in the form of the spermatophore and and antennæ as well as caudal stylets. The stylets are too short for A. longiremis. The fifth feet of the male were seen only in immature specimens. From A. laxa it is easily distinguished by the absence of spines upon the last thoracic segment while the fifth foot of the female is very unlike that of A. denticornis.

GENUS TEMORELLA. Claus.

The genus Temora was founded by Baird, to receive one of the Calanidæ found

abundantly on the English coast and since identified in various places along the shores of the German ocean. Much confusion has existed from the first in the nomenclature of this group resulting, in the first place, from the assumption that the type of the genus Temora is identical with *Monoculus finmarchicus* of Gunner, falsely identified with *Cyclops longicornis* of Mueller, and later from the fact that the male of one species has been wedded by our synonomy to the female of a distinct though closely allied form.

Still later it became evident that two sections could readily be distinguished within the genus which have since then been elevated to generic rank by Claus. Both these groups agree in several characters, such as the following: Head distinct from the thorax, fourth and fifth thoracic segments closely united, frequently only the lateral or pleural portions of the latter being evident, abdomen composed of four segments in the male and three in the female, antennæ shorter than the body, twenty-four- (or twenty-five?) jointed, right male antenna geniculate, inner rami of swimming feet, one- or two-jointed, in the female small, in the male prehensile. As restricted by Claus the genera stand related as shown by the following tabular diagnosis:

TEMORA.

Antennæ of male 24-jointed, geniculation between joints 18 and 19. Maxillæ and maxillipeds rather large.

First foot with 2-jointed inner ramus.

Fifth feet 1-branched, the left in the male 3-jointed, dactylate, right 2-jointed, unguiculate, in the female apparently 2-jointed.

Habit, marine.

Sp. 1. T. longicaudata, Lubbock (= T. finmarchica, Baird, etc.) Angle of last abdominal segment rounded, left foot of 5th pair in male 3-jointed, with a long, immovable process on the first joint, the two remaining forming an apposible clasper, antennæ as long as whole body. (North Sea.)

Sp. 2. T. armata, Claus. Angle of last abdominal segment produced forward, left foot of 5th pair in the male with the terminal joint expanded into a plate, antennæ reaching *nearly* to end of the abdomen. (Mediterranean.)

Sp. 3. T. dubia, Lubbock. (As identified by Brady.) Exactly as in "T. armata*, save that the antennæ are said to be *about* as long as the cephalothorax. (Pacific and Atlantic Oceans.)

*The agreement is so close, even in minute details, that a varietal distinction at the utmost seems demanded. See *Claus*, Ueber die Gattungen Temora und Temorella, and *Brady*, Challenger Copepoda.

TEMORELLA.

Antennæ 24- (25?) jointed, geniculation between joints 18 and 19 Maxillæ and Maxillipeds quite short.

First foot with 1-jointed inner ramus.

Fifth feet 1-branched, both 3-jointed, the left with an expanded apex, the right with a strong claw. in the female obviously 3-jointed, the penultimate segment bearing a strong spine. Habit sub-marine or flluvatile.

Sp. 1. T. velox, (Lillg.) Brady, (=T clausii, Hoek.) Penultimate joint of the 5th foot of female with a single spine externally, caudal stylets 4 to 5 times as long as wide and feebly spined. (Scandinavian and North European coasts.

Sp. 2. T. affinis, Poppe. Penultimate segment of fifth foot in the female, with two spines externally, caudal stylets 6 to 7 times as long as wide. Segmentation of last joints of male antennæ more obvious. (Same localities and rivers Rhine, Elbe, etc.) [See below on T. hirundo.] Poppe very positively declares T. clausii to be identical with the T. velox of Lilljeborg, but Claus explains that the male seen by Lilljeborg was T. clausii. As identified by Brady, in England, T. velox evidently corresponds to T. clausii, which should therefore probably yield priority to the older name.

T. affinis occurs very abundantly in rivers and estuaries of, as well as in the Gulf of Mexico.

Temorella affinis, *Poppe.*

(Plate I, Figs. 3, 4. 5, and 6. Plate II, Figs. 9–12.)

Temora velox JILLJ., Pars. De Crust. ex ordin. tribus Cladoc. Ostrac. et Copep.
Temora affinis, POPPE, Ueber eine neue Art Temora, Abh. naturw. Vereins zu Bremen, Tome VII, 1880.
Temora affinis, CLAUS, Ueber d. Gattungen Temora u. Temorella, Sitzb. k. Akad. Wien, LXXXIII, 1881.
(var. ?) *Eurytemora hirundo*, GIESBRECHT, Kieler Freilbend. Copep., 1881.

Form rather robust, about 1.60 mm. long, variously ornamented with colored markings; head separated by an obvious suture from the thorax, rounded anteriorly, with small forked beak; antennæ about as long as the thorax, 24-jointed, the 12 basal joints being quite short and uniform, in the right male antenna geniculated and thickened beyond the 12th, the geniculation being between the 18th and 19th, the 17th and 18th segments furnished with comb-like or file-like plate against which plays a similar shorter plate on the 19th; the antennules short, 3-jointed ramus with 12 setæ, 2-jointed ramus with about 15; jaw with 8 acuminate teeth and a small spine; mandiblar palp with a 2-jointed and 4-jointed ramus, the former with 7 terminal and 4 lateral setæ; maxilliped very small, 6-jointed; first pair of feet with the inner ramus 1- the other 3-jointed, remaining swimming feet, 2- and 3-jointed; fifth foot in the female with 3 joints (apparently 4), the basal bearing a single external spine, the second, two external spines and a strong internal process, the terminal joint a long pectinate seta and a small spine; the fifth feet of the male both 4-jointed, the right terminating in a long, irregularly excised claw and the left in a fan-shaped expansion with a central spine. The abdomen is 5-jointed in the male and terminates in two long slender stylets, but sparsely beset with bristles along the inner margin, while in the female the abdomen is 3-jointed and the shorter stylets are densely spinous and bear numerous fine setæ medianly. The second segment of the abdomen in the female is produced into a spiniferous process with small spines on its sides. The caudal stylets are about six times as long as wide in the female and nearly eight times in the male, the preceding segment being densely covered with short spines in the former, while in the latter there is on either side a cluster of longer stylets. The eggs are carried in a large spherical mass beneath the abdomen as in *Osphranticum* (Potamoichetor.) The one-jointed ramus of the first foot bears seven setæ, the terminal joint of the other ramus, five setæ and three spines; the second segment of the inner ramus of second and third feet bears six seta, its predecessor three, while the terminal segment of the outer ramus carries five setæ, one long, serrated, apical spine and a short external spine; the fourth foot has but five setæ on the apical segment of inner ramus and five setæ, a serrated spine and two small spines upon the opposite branch.

This species was first noticed in America by the writer, in an appendix to his paper in the 12th annual of the State Geologist of Minnesota. Careful study of abundant material since then shows the identification well-founded, although a few slight differences between this and the north European species can be detected which are by no means so great as the variations in the figures of the several European authors who have described

the species. Should it prove that this like other Calanidæ is dimorphous T. clausii may disappear and the old name T. velox will then be restored for both forms.

Claus is certainly in error in calling the fifth pair of feet 4-jointed, as shown by his own figures and especially those of Poppe. Great interest attaches to this find, because it seems to indicate that the same morphological species has arisen under similar conditions in isolated stations. Should the species be found along the Atlantic coast, however, this assumption will be unnecessary.

The curious resemblance, amounting almost to identity, betwen the Temora armata of Claus, and Brady's T. dubia, is likewise instructive, leaving very little doubt of close genetic relationship.

Boeck's description of *T. inermis* is here translated for the sake of completeness. (See Oversight over de ved Norges Kyster iagttagne Copepoder; Vidensk.–Selskab. Forhandlinger, 1864, p. 16.)

Length about 1.50 mm, transparent, colorless, with yellow viscera and a yellow band on the posterior part of the head and another upon the first segment of the abdomen. The body greatly elongated, slender. Head divided by a transverse suture into two parts, likewise the fourth and fifth segments distinctly separated. The fifth segment in the male rounded, in the female accuminated. The first joint of the abdomen in the male, but the middle one of the female the shortest. The caudal appendages elongate, but shorter upon the abdomen of the male. The outer seta attached nearer the middle than the end of the caudal stylets. The anterior antenna of the male is strongly swollen in the middle and is armed with small spines upon the eighth to the twelfth joints. Last foot of the female two-jointed, first segment short; second longer, oval, provided on the outer angle with a spine, on the inner, with a longer curved spine-like process, at the apex is a long, straight spine. The fifth legs of the male are three-jointed; second joint of left limb shortest, the third expanded at the end; first joint of the right foot long, but less broad; spines on the inner angle very small; third segment rather longer and provided at the end with simple teeth.

The Temorella (Eurytemora) hirundo of Giesbrecht differs from T. affinis only in three very significant particulars, first, the body is more slender, second, the caudal stylets are considerably longer, third, the last segment of the thorax is rounded instead of acute, and bears minute bristles. The close agreement of the other parts suggests a local race or variety, but it may be best to retain the name notwithstanding.

Genus Pseudo-diaptomus. (Herrick.)

Resembling Metrida and Diaptomus; compactly framed; cephalothorax 6-jointed, last two segments coalescent above; head rounded in front, beaked; eye small; antennæ appearing 22-jointed in both sexes, longer than the thorax; the right male antennæ genicuiate as in Diaptomus; antennules bi-ramose, both rami rather short, inner one seeming but two- or three-jointed; mandible ten-toothed; maxillipedes well developed; feet all bi-ramose save the last, both rami 3-joited; first feet smaller; fifth feet with inner ramus obsolescent, in the male nearly as in Diaptomus, in the female rather slender,

simple, 3-jointed; abdomen in the female 3-jointed, in the male 5-jointed; stylets in the female longer; ova-sac single; spermatophore pear-shaped, liable to be mistaken for eggs.

Pseudo-diaptomus pelagicus, *Herrick.*

Final Report on Crust., Geol. Surv. of Minn., Vol. XII.

Rather compact; thorax alike in the sexes, antennæ short, seeming 22-jointed; first foot small, both rami 3-jointed; fifth feet in the male with but small rudiments of the inner rami, basal portion heavily armed with short teeth, otherwise almost as in *Diaptomus;* fifth feet of female slender, alike; abdomen in male very slender, with short stylets armed with five terminal setæ and a series of bristles on the inner margins, distal margin of segments of abdomen toothed; a series of spines also ornaments the middle of the first segment below; abdomen of female short and very spiny, first joint thick, second slender, oblong, third joint short; length of abdomen supplemented by that of the elongated stylets, which are spinulous on the edges; ova-sac ovoid, eggs numerous; opening of operculum vulvæ with lateral projecting lips.

This species is ornamented with irregular markings of brownish color which gives it a strange appearance not observed in any other copepod. The size is like *Temora velox*, which the female resembles a little, a resemblance enhanced by the elongated stylets.

This genus affords an illustration of a "missing link" connecting the fresh-water genus Diaptomus with its fellows of the sea. In most respects the species closely resembles Diaptomus, while in others it approaches Drepanopus, and in still others Euchæta. The entire reduction of the inner branches of the fifth feet in both sexes is especially remarkable in view of the three-jointed inner rami of all the other feet. The fifth foot in the male is exceedingly like that of *Drepanopus pectinatus*, Brady, while those of the female are on the same numerical plan; in that genus, however, the male antenna is not geniculate and the first foot has the inner ramus one-jointed. The genus Euchæta is a somewhat miscellaneous assemblage, with some species resembling Pseudo-diaptomus. In some respects Centropages is likewise similar.

Genus Diaptomus.

Though the most abundant and widely distributed fresh-water genus of Calanidæ, our American species need careful revision. Pending such study, which must be based on a painstaking study of the last stages of development, we can only say that at least three species are found in Alabama, one being the *D. sanguineus* of Forbes, another, *D. stagnalis*, and a third, like *D. pallidus*, Herrick.

Genus Osphranticum. Forbes.

Cephalothorax six-jointed, distal segments evident; abdomen, in the male, five-jointed, in the female four-jointed; antennæ twenty-four jointed, the right geniculated as in Centropages; first pair of feet with the rami both three-jointed, like the following; feet of the fifth pair, in the female, like the preceding, but with a spine of the joint preceding the terminal one enlarged and divaricated somewhat as in Centropages; in the male, the right with a two-jointed outer ramus, the terminal joint of which is spined and bears near its base a blunt expansion of its inner margin; outer ramus of left foot three-jointed, armed with unequal spines; inner branches smaller, similar, three-jointed; the terminal joint bearing curved spines; ovary and testes as in Diaptomus, with which the mouth parts agree in the main; eyes median, confluent.

Osphranticum labronectum, *Forbes.*

Potamoichcior fucosus, HERRICK, Cyclopidæ of Minnesota, etc., p. 224.

Rather slender, and in size, as well as general appearance, resembling the smaller forms of Diaptomus; antennæ rather stout, reaching but little beyond the feet, appendaged as in Diaptomus, in the male strongly geniculated, but somewhat variously so; the six joints preceding the terminal four are thickened; those preceding the joint or hinge are arcuate on the distal margins; the secondary antennæ are about as in Diaptomus; mandibular palp two-branched, the outer three-jointed, the inner two-jointed; the terminal joint of the shorter branch bearing seven setæ, of the other, four, the proximal joint of the other with three stout spines; the maxillæ nearly like Diaptomus; the processes have respectively the following numbers of setæ: the basal plate eight, the small processes at base of posterior branchial appendage one, the appendage itself twelve, terminal portion three groups, first containing nine, the second three, and the third four or five, the upper of the anterior processes two, and the lower three; fifth feet nearly like the others in size; the right in the male having the outer branch but two-jointed by the coalescence of the two outer to form an arcuate and deformed appendage, armed at the end with three stout equal spines; corresponding branch of left foot three-jointed; the terminal joint bearing three unequal spines, each of the preceding joints only one; inner branches similar, three-jointed; terminal joint being short and armed with three short lanceolate setæ and three longer ones, two of which are curved so as to be slightly prehensile; fifth foot of female with both rami three-jointed; inner ramus much smaller; penultimate segment of the outer ramus extending into a large lanceolate process; ova-sac long-ellipsoidal or spherical, reaching nearly to the end of the caudal setæ. Length, .09 in., Cephalothorax, .05 in.

In Alabama this species is very abundant and seems usually to delight in flowing water rather than stagnant or quiet pools. The genus finds no homologue apparently

in the fresh-waters of the Old World. It would seem to be more prolific towards the south and may belong to a southern fauna of which we have other indications.

Genus Epischura. (Forbes.)

Closely resembling the European genus Heterocope, the place of which it takes in America. Thorax moderately slender, six-jointed, rounded in front, cervical suture evident; abdomen five-jointed in the male, three-jointed in the female, in the male with a prehensile appendage upon the second segment, sometimes assisted in its function by the modified remaining segments; antennæ 25-jointed, somewhat geniculate on the right side in the male, shorter than the body; jaws with about seven to eight teeth; second maxilliped with strong spines, five- or six-jointed; legs of the first four pairs all with one-jointed inner rami; fifth feet of female with one ramus each, similar, of the male unlike, the right forming a more or less perfect dactyl, while the left is similar to those of the female; caudal stylets short, with but three spines. Two species are known, one (E. lacustris) from the Great Lakes, the second from rapid mountain streams in Alabama. E. lacustris has the abomen curved in both sexes, while in the male it is curiously modified and armed and has the stylet of one side similarly affected. Our species is less highly modified though the abdominal processes are more free hence requiring less intervention of the abdomen itself.

Episcura fluviatilis. *Herrick.*

Of small size (.045 in. long.) Body rather slender, color greenish blue. The abdomen is perfectly straight and the three caudal setæ are of nearly equal size. The abdomen of the male is straight, but has a strong process on the left side which bears a movable claw laterally and a small second segment which terminates in two small spines. Antennæ of moderate length, in the male geniculate beyond the twentieth segment, joints fifteen to twenty slightly thickened and spiny; antennule with eleven spines upon the terminal joint of two-jointed ramus; jaws eight-toothed, most of the teeth emarginate; palp bi-ramose, one-jointed ramus with five spines; swimming feet similar, the inner, one-jointed ramus with five setæ; fifth feet of the female slender, three-jointed, terminal joint extending into a claw and armed with two small spines. Spermatophore as in Diaptomus. This very peculiar form was found in Mulberry creek, Cullman county, Alabama.

FAMILY CYCLOPIDIÆ.

This family differs from the Calanidæ in the rather shorter antennæ, simple four-jointed antennæ, rudimentary fifth foot, double ova-sac and the absence of the heart. The antennæ of both sides are modified in the male, while the fifth feet are not subject to modification. The genus Cyclops alone represents the family in fresh water. No

marine form has as yet been reported from America. The species of Cyclops identified from Alabama are the following, for descriptions of which the reader is referred to the writer's Final Report, or a more inclusive work soon to appear.

1. *Cyclops ater*, Herrick. The most characteristic southern species and expressing the extreme of compactness.
2. *Cyclops viridis*, Jur. common.
3. *Cyclops parcus*, Herrick.
4. *Cyclops thomasi*, Forbes.
5. *Cyclops modestus*, Herrick.
6. *Cyclops serrulatus*, Fischer.
7. *Cyclops elegans*, Herrick.
8. *Cyclops fluviatilis*, Herrick.
9. *Cyclops diaphanus*, Fischer.
10. *Cyclops phaleratus*, Koch.
12. *Cyclops fimbriatus*, (= crassicornis) Fischer, (Plate VII, Fig. 2.)

(See *C. simplex* below.)

The following descriptions are appended in order to sharply define those species especially characteristic of the southern fauna.

Cyclops ater. *Herrick.*

"This is our most striking species and loves the clearer flowing waters. The thorax is broadly oval and, usually, of a deep color. Antennæ as long as the cephalothorax (1.2 mm.), slender, and tapering toward the end; last three joints rather short, the last joint furnished with an unserrated knife-like ridge as in C. tenuicornis; maxillipedes rather large; fifth foot one-jointed, armed with three subequal spines; abdomen rather short, last segment especially short; stylets of moderate length; setæ rather short, internal seta much longer than the outer, lateral seta situated near the end of the stylet; eggs pale. Color deep blue or gray. Length 2.1 mm. The young can be recognized without a glass by the band of deep color which crosses the thorax in the middle."

This species has been collected in different parts of the Mississippi valley from Alabama to Minnesota, but is nowhere very abundant, being rather more so southwardly.

Cyclops modestus, *Herrick.*

American Naturalist, 1883, p. 500 (May.)

This small species, 1.0 mm. long, was first recognized in Cullman county, Alabama, but occurs also in our lakes. The color varies, but very characteristic is the peculiar shining or glaucous surface of the strongly arched thoracic shield and the evenly curved segments of the abdomen. The antennæ reach but little beyond the very long first segment; they are usually 16-jointed, but I have notes of a similar form in which the antennæ are 17-jointed. The rami of the feet are all 3-jointed and are peculiar in their ar-

mature. The fifth foot is obscurely 3-jointed, the second joint bearing a short spine and the terminal joint two spines of varying length. The stylets are once and a half as long as the last segment and are peculiarly excavated for more than the lower third, from the point where the lateral spine is situated. The outer terminal seta is short, the others being sub-equal and also short. The opening of the spermatheca is elongated, oval. The antenna of the male is divisible into five regions, the third being formed by the thickening and coalescing of four or more segments.

Cyclops fluviatilis, *Herrick.*

Cyclops magnoctavus, CRAGIN. A contrib. to the History of the Fresh-water Copepoda. *Trans. Kansas Academy of Science*, May, 1883.

This small species, although apparently restricted to America, is one of the most abundant forms in the larger lakes and especially in streams. In its smaller age-form it is barely visible to the eye, while the larger and particularly the higher colored condition is readily distinguished. In appearance it somewhat reminds one of *Cyclopsina gracilis*. The species was first described by the writer in 1882, in the *Tenth Annual of the Minnesota Geol. Surv.*

The full grown female measures about .70 mm, but the greater number of adult individuals measure only about .55 mm. In a specimen measuring .57 mm, to the end of the stylets, the following proportions were noted: First segment of thorax .22 mm, second and third segments each .056, fourth .032; the total length of abdomen .17, stylets .032 mm. The longest seta measured .128 mm, the outer median .10 mm. It will be seen from these figures that the form is slender and the first thoracic segment proportionally much longer than in any other species of the genus. In this respect as well as in the armature of the swimming feet the species approaches the calanidæ. The antennæ are nearly as long as the whole thorax, and are remarkable for the elongation of the seventh to ninth segments. There are long setæ upon the first and fourth segments. The last joint of the antennæ is hinged, and apparently ornamented with a slight ridge, and, together with the next following, is slightly curved outward. The antennules are elongated and slender. The labrum has about twelve small teeth. The maxillæ have the usual form. The feet are peculiar in the exceedingly long setæ. The armature of the terminal segments of the first, third and fourth pairs of feet, is as follows:

	Outer ramus.	Inner ramus.		Outer ramus.	Inner ramus.
I.	ex. 3 spines.	ex. 1 seta.		ex. 3 spines.	ex. 1 seta.
	ap. 2 setæ.	ap. 2 setæ.	III.	ap. 1 spine, 1 seta.	ap. 2 setæ.
	in. 3 setæ.	in. 3 setæ.		in. 4 setæ.	in. 3 setæ.

	Outer ramus.	Inner ramus.
IV.	ex. 2 spines.	ex. 1 seta.
	ap. 1 spine, 1 seta.	ap. 1 spine, 1 seta.
	in. 4 setæ.	in. 2 setæ.

The fifth foot is small, one-jointed and bears three small setæ. The abdomen is slender though rather short. The stylets are about three times as long as broad and are

quadrangular in outline, the outer of the terminal setæ being a short spine, shorter than the stylet. The setæ may or may not be webbed. The egg sacs are appressed and contain four or five eggs in the first state and a few more in the post-imago. The eggs are relatively larger than in most species, though as a rule small species have eggs a little smaller than those of larger forms. The two dimorphic states are very evident in this species as already hinted and are found to depend in part at least upon the habitat. The colors are frequently brilliant, varying from a deep indigo blue to greenish and brownish. The coloring matter is distributed rather irregularly, but is usually deepest between the bases of the feet, toward the end of the antennæ and in the last segment of the abdomen. Males of this species are even more slender, measuring .75 mm., the abdomen being .28 mm., stylets .06, first thoracic segment about .28 mm., and the longest caudal seta .24 mm. The antennæ are long and so curiously geniculated as to resemble the antennæ of calanidæ. The abdomen in young specimens, before the segmentation is perfect, often appears very long, and it often happens that the fourth pair of feet are still 2-jointed in oviferous females.

Cyclops Diaphanus, *Fischer?*

(Plate VII, Fig. 3.

Description of the Female. The body, not including the caudal setæ, measures from .65 to .80 mm. The following are measurements of a rather small specimen; first segment of cephalothorax .24 second segment .068, third segment .060, fourth segment .036 mm; the remainder of the body to the stylets measures .24 mm; while the stylets themselves are .024 mm. long and bear a lateral spine about one-third their length from the apex. The longest seta is .24 mm. long, the outer median seta being about .19 mm. The body is comparatively rather slender and tapering, with an unusually long first thoracic segment. (Measurements of a large specimen of this species may serve to indicate the observed fluctuation in size: Length .81 mm., thorax .50, abdomen 31, stylets .06, longest seta .40, outer median seta .36 mm.) The antennæ are considerably shorter than the first thoracic segment, being about .19 mm. long, the seventh and eighth joints about equal and the longest of the eleven segments. The first joint is very large. The antennæ in a state of rest assume a curved position. The antennules are small, the terminal segment measuring (in the animal first above referred to) .032 mm. The labrum has six similar teeth which are bordered on either side by a larger one. The longest joint of the outer maxilliped measures .06 mm. All the feet are usually two-jointed in both rami. The outer ramus of the first pair of feet has the terminal joint armed externally with three stout spines, terminally with two setæ, and internally with three setæ. The second and third pairs of feet are alike in their spinous armature, the outer side of the terminal segment bearing three spines, the end a very large toothed spine and a seta, and the inside four setæ. The fourth foot has two spines on the outside of the terminal joint, a heavy spine and a seta terminally, and four setæ within, while the terminal joint of the inner ramus bears externally one spine, apically a short spine and a seta,

and internally three setæ. The fifth foot consists of a fleshy basal segment, more or less coalescent with the last thoracic segment and bearing a curved spine externally, and a terete terminal segment .012 mm. long, which bears a seta four times its own length. The abdomen is slender and its last segment bears a series of spines above on the posterior margin. The egg sacs are appressed and contain eight to twenty rather large ova. The color is bronzy and opaque.

Cyclops simplex, *Poggenpol.*

(Plate VII, Fig. 1.)

Description of the Female. The form is very slender, an average individual measuring between .95 and 1.00 mm. exclusive of the caudal setæ. The following detailed measurements of a specimen measuring .976 mm. will serve to exhibit the proportions of the parts: First thoracic segment .30 mm., second segment .08 mm., third segment .08 mm., fourth segment .056 mm., fifth segment .024 mm.; first (apparent) abdominal segment .16 mm., second segment .08 mm., third segment .048 mm.; caudal stylets .088 mm., outer seta .08 mm., outer median .30 mm., inner median .46 mm., inner .20 mm., dorsal .06 mm.; the lateral seta is .036 mm. from the end. The antennæ reach nearly to the base of the thorax when reflexed, and are quite strong. They resemble those of *C. tenuicornis* in several particulars, but since it is desirable to distinguish this species with the greatest possible accuracy, the following numbers are given to express the relative length of the several segments beginning with the first: (1)20, (2)5, (3)3, (4)10, (5)7, (6)4, (7)11, (8)5, (9)5, (10)5, (11)7, (12)7, (13)5, (14)6, (15)10, (16)15, (17)14. The fourth, eleventh, fourteenth and fifteenth segments bear the longest setæ. The last two segments are armed with a knife-like ridge similar to that found in *C. tenuicornis*, this ridge is serrulated on the last segment and near the end is cut by a deep incision so that the terminal part is like a hook notched upon its convex outer part. The antennules are slender and but moderately spinous, the first three segments being almost exactly equal (.06 mm.) while the terminal segment is as long as the basal segment of the antennæ (.08 mm.) The labrum is armed with thirteen small teeth. The larger maxilliped is pearled on the posterior margin of its largest segment. The armature of the terminal joints of the feet is as follows:

I.	Outer ramus	ex. 1 spine. ap. 1 spine, 1 seta; in. 3 setæ.	Inner ramus.	ex. 1 seta. ap. 1 spine, 1 seta. in. 2 setæ.
II. and III.	Outer ramus.	ex. 2 spine. ap. 2 spines, 1 seta; in. 3 setæ.	Inner ramus.	ex. 1 seta. ap. 1 spine, 1 setæ. in. 3 setæ.
IV.	Outer ramus.	ex. 1 spine. ap. 2 setæ, 1 seta, in. 3 setæ.	Inner ramus.	ex. 1 seta. ap. 2 spines. in. 2 setæ.

The fifth foot is two-jointed, the basal joint is short and bears a tubercle carrying a seta .06 mm. long, the terminal segment is terete and bears a spine .10 mm. long apically and another as long upon the middle of its inner side. The cement gland is of peculiar shape, resembling that of *C. parcus* exactly. The last segment of the abdomen is spiny upon the posterior margin above. The color is usually pale, but may be ornamented with bluish suffusions.

Though closely allied with the species in America identified with Sars' *C. oithonoides* there can be no doubt that two forms occur, this one being nearly exactly like the species described by Hoeck as *C. leeuwenhœkii.* The description and drawings are given as a basis upon which to distinguish other allied species. The form from the southern states originally called C. tenuissimus is probably this species though possibly distinct. The use of the name C. simplex for the species may be objectionable.

FAMILY HARPACTICIDÆ.

An enormous family, consisting of much more compactly framed animals than either of the preceding families. The body flattened or sub-cylindrical. Abdomen usually not much smaller than the thorax, from which it is not separated by a sudden constriction; antennæ rather short, 4- to 10-iointed; mandibles strongly toothed, palpate; maxillæ well developed, palpate; first pair of maxillipedes with strong teeth at the end, second pair usually forming a prehensile claw. The first pair of feet are often turned forward or prehensile; fifth pair one- or two-jointed, serving as egg supports in the female; ova sacs single.

Most species live among sub-aquatic vegetation.

Nearly thirty-five genera are known and about eighty-five species, only two of the genera being found in fresh-water.

Genus Harpacticus, Milne-Edwards.

Body elongated and moderately depressed; head beaked; first and second abdominal segments in the female united, the abdomen, therefore, in the female, (apparently) 4-jointed, in the male 6-jointed; antennæ 9-jointed, in the male greatly deformed by enlargment of the fifth and sixth segments; antennules with small 2-jointed palp; palp of mandible biramose and of considerable size; maxillæ with four-spined apical portion and a four-parted spinous palpus; first maxilliped small and strongly armed; second maxilliped very large, chelate; first foot with both branches two-jointed, the outer being elongate; the following pairs with both rami three-jointed, the second joint of the inner ramus of the second pair in the male is furnished with a long spine and the third has the outer ramus chelate; fifth feet small, unlike in the sexes. Three species with varieties are now recognized all from the North Atlantic and adjacent waters. Our own species differ but little from the Mediterranean variety of the H. chelifer. The remaining species are *H. fulvus*, Fischer, and (?) *H. flexus*, Brady and Robinson.

Harpacticus chelifer, *Mueller.*

(Plate II, Figs. 15, 17, 19, 20, and Plate VI, Fig. 5.)

Cyclops chelifer, O. F. Mueller, Prodr., 1776; Entomos., 1785.
Cyclops armatus, Tiesius, Mem. Acad. St. Petersb, 1812.
Arpacticus chelifer, Baird, Brit. Entom., 1840.
Harpacticus chelifer, Claus, Freileb. Copepod. 1863.
(var.) *Harpacticus gracilis*, Claus, Freileb. Copepod. 1863.
(var.) *Harpacticus nicœnsis*, Claus, Copep. v. Nizza. 1866.
Harpacticus elongatus, Boeck.
Harpacticus chelifer, var? Herrick, Final Rep., 1884.

Our species agrees most closely in several respects with the variety called by Claus, H. gracilis, but seems intermediate, in several respects, between it and the typical H. chelifer. The poverty of material at our disposal makes it wiser to accept the conclusion of later writers that these species are identical and leave the exact relations to later observation.

Body moderately long, anterior segment nearly as long as the following three, abdomen comparatively short (in our form apparently rather longer than in the type,) second and third abdominal segments united in the female and thickened, the last segment and the caudal stylets short, all the abdominal segments with spinous armature below; antennæ of the female slender, with a slender styliform appendage from the long fourth joint, male antennæ with the third and sixth segments largest, the latter being greatly swollen, the following three joints small and forming a prehensile organ; antennules short, two-jointed, terminal segment with four geniculate and three straight setæ, palp minute, two-jointed; mouth parts with the generic characters; second maxilliped dactylate, with a toothed excavated portion to oppose the claw; first foot with both rami two-jointed, the other being greatly elongated and both spiny margined and clawed; the other feet with both rami three-jointed; fifth foot of male with the second joint narrow, with five nearly apical setæ, that of the female oval, with five setæ, while its basal joint is expanded within and bears three or more spines.

Length of entire animal somewhat under 1 mm. Mississippi sound and other parts of Gulf of Mexico, not found in rivers. The ova are frequently very numerous and are bourn by the female in a discoid mass beneath the abdomen.

GENUS LAOPHONTE, Philippi.

Body more elongate than Harpacticus, especially the abdomen, segments angular, often with spinous armature sometimes amounting to enormous processes; antennæ 4- to 8-jointed, modified in the male as in Harpacticus; antennules often relatively large, with minute palp; palp of mandible small; maxillæ well armed with a considerable palp; second maxilliped dactylate, slender; first pair of feet with the longer branch 2-jointed,

clawed, the shorter ramus 2- or 3-jointed; inner rami of the other swimming feet (except occasionally in males) 2-jointed; fifth feet nearly as in *Canthocamptus*, which in several respects the genus resembles. Some eight species are recognized with none of which our American form agrees, though sharing some characters of *L. similis*, Claus, and *L. curticaudata*, Boeck. Although our knowledge of the species rests upon a single gathering containing only the female, it may be safe to apply a specific designation to the above, which, in connection with the habitat will be easily recognized.

Laoponte mississippiensis, *sp. n.*

(Plate I, Figs. 14, 15; Plate II, Fig. 18; Plate VI, Fig. 5.)

Laoponte similis? Herrick, Final Report, etc., 1884.

Body stout, segments angular, not heavily spined, front produced into a prominent rostrum, (our figure represents the whole body as too stout and the second seta of the caudal stylets too long), eye large; antennæ six- or seven-jointed, the fourth joint small and bearing a rather short process; antennules nearly as long as the antennæ, palp minute, apical segment with four setæ; maxilliped oval, with a claw as long as the main joint; first foot with the inner ramus 2-jointed, the basal segment being very long, exceeding the entire outer ramus, terminal segment very short, clawed and finely pectinate behind; outer ramus 3-jointed; swimming feet with 2-jointed inner rami; fifth foot with a broad basal joint with three setæ within, terminal segment oval, with five unequal spines.

Genus Bradya, Boeck, (1872.)

Antennæ very short, 6-, 7-jointed; antennules of moderate size longer, than antennæ, with a 2- or 3-jointed palp; mandibular palp large; maxillipeds rather large, outer branch (first foot-jaw of Brady) much as in *Calanidæ;* first four pairs of feet nearly alike; fifth pair small, not lamellate.

This peculiar genus is not yet well circumscribed and defined, and it is much to be regretted that lack of time prevented from ascertaining how far the western species agrees with the generic characters of the European form and thus determining the validity of the assumed generic criteria. That our species is a member of the genus can not be doubted, but the hurried examination which could be devoted to it failed to cover the entire structure.

Bradya limicola, *Herrick.*

Am. Nat. Feb., 1883; Final Rep., 1884.

Body flattened; free margins of the segments of the dorsal carapace rather long; little separation between abdomen and thorax; abdomen cylindrical, rather long; stylets

short; distal margin of the segments spined; antennæ very short, 6- or 7-jointed, hardly longer than the movable beak; second antennæ much longer, 3-jointed; palp long, 2-jointed; mandibles palpate, teeth fine, much as in Calanidæ; palp bi-ramose, second ramus very small; maxillæ of moderate size; maxillipeds large, outer one as in Calanidæ; first four pairs of feet bi-ramose, each ramus 3-jointed; fifth foot small, with two terminal digitate processes and a seta on either side. The male is at least a third smaller and has longer caudal stylets; the antennæ are modified, but very short. *The eyes are wanting in both sexes.* This very interesting species was collected in the brackish water of a ditch shaded by high sedges so that the sun could hardly penetrate. I did not find any representative of the genus in the open waters neighboring, but it is hardly to be doubted that such exist. This species seems quite distinct from *Bradya typica* of north Europe and may constitute a new genus.

The only other blind copepod with which I am familiar is *Attheyella*, which is circumstanced somwhat as the above. The European *B. typica* is pelagic; ours dwells in darkened ditches and seems to furnish another illustration of the effects of seclusion upon the visual organs.

Ocean Springs, Mississippi.

It is a matter of regret that nothing can now be added to the original description here quoted, repeated search having failed to rediscover it, though probably occurring along the Gulf coast in any appropriate place.

Genus Amyone, Claus.

This most interesting genus is still very superficially known, having been noticed by but four writers, the minute size and limited habitat serving to shield it from observation. Claus, who first discovered the genus, applied the name once given to a stage in the cycle of development of the cyclops, saying:

"The body of this highly remarkable form, represents, in its general form, an intermediate stage between the nauplius (cyclops larvæ) and the mature Copepods. The oval, almost spherical [sic] form, the slight development of the abdomen, and the enlargement of the anterior thoracic segment recall the structure of the larva, while the almost complete segmentation of the body, the jointing of the antennæ and the swimming feet, as well as development of the reproductive organs, make the maturity of the creature certain." (Beitr. zur Kenntniss der Entomostraken.)

Indeed these more or less discoid forms seem apt illustrations of the possibility of extreme deviation in form and appearance without in a single organ obscuring the evident homologies. The essential alliance with other members of the family could never be questioned. The genus may be characterized as follows:

Body much compressed; dorsal margin strongly curved; head very large, produced and angled below; antennæ 6- to 8-jointed; antennules palpate, 3-jointed; second maxillipeds long, chelate at the end; last thoracic and anterior abdominal segments enlarged; fifth feet leaf-like, large; in the female composed of two, in the male of one joint; first pair of feet bi-ramose, each ramus one jointed. No member of the genus is much over

0.5 mm. long. The integument is very dense and vesicular. The maxillipeds with their powerful chelæ are similar to those of Harpacticus.

Amyone intermedia, *sp. n.*

(Plate I, Figs. 10, 11.)

Our American species though so imperfectly known can hardly be indentified with either of the known species. It most nearly approaches A. sphærica, but differs in many particulars. Head segment greatly produced, terminating in a sculptured margin like the cephalic shield of Gammarus, etc.; three following segments nearly equal, the next enlarged, the following smaller and succeeded by a series of coalesced abdominal segments greatly produced below and serrately toothed, remaining abdominal segments small and the stylets obscure. The antennæ appear to be 6- or 7-jointed; antennules as in A. sphærica 3-jointed with a minute palp on the base; outer maxilliped with a triangular terminal segment more nearly as in A. longimana than sphærica; first feet long, the rami short, 1-jointed, remaining three pairs long and with both rami 3-jointed, fifth foot in adult females very large, foliacious, 2-jointed.

Gulf of Mexico.

Genus Canthocamptus.

The following species described in my Final Report are all the truly fresh-water forms encountered in the Gulf states:

Canthocamptus tenuicaudatus, Herrick. (By misprint *C. tenuicaudis* in Final Report.)

Canthocamptus minutus, Mueller.

A small species found in the brackish waters of Mobile bay seems to owe its peculiarities to the influence of the minute and varying quantity of salt in the water.

Canthocamptus mobilensis. *sp. n.*

(Plate VI, Fig. 6.)

A very small species closely related to the American variety of C. northumbricus. Body slender but closely knit, sub-cylindrical; abdomen long, narrow, terete and of nearly equal width; head beaked; eye large; antennæ short, eight-jointed, the third, fifth and seventh segments being very short, fourth segment large and thick, bearing a very large sword-shaped flagellum longer than the remainder of the antenna; palp of antennules small, tri-spinose; first foot with very short three-jointed rami; fifth foot of female with five sub-equal spines on the inner lobe of the basal joint and two long and three shorter spines on the end of the quadrate second joint; Ova sac very large, spherical, eggs numerous, large; lower margins of the abdominal segments spinulous; caudal stylets short, sub-quadrate in outline, two setæ, the inner being as long as the abdomen in

the male, but much shorter in the female. The adult male was not seen. This species approaches C. minnesotensis in several respects and is about .50 mm. long.

ORDER OSTRACODA.

In some respects the structure of the animals of this order is very primitive and it has been thought that the order was one of the earliest branches to separate from the crustacean stem. Conformably to this theory the remains of Ostracoda are found in rocks of the earliest fossiliferous periods. These animals are especially adapted for such preservation since the compact and unsegmental body is enclosed in a more or less indurated limy or chitinous bivalved shell. The shell is closed by adductor muscles and opened by a ligment as in mollusks and consequently these animals are often mistaken for minute shell-fish. The abundance of the fossils of this group makes them a valuable geological criterion and accordingly they are now receiving much more attention than formerly. At the foundation of such study, however, must lie a familiarity with existing species, an accomplishment possessed by very few zoologists not to say geologists. The majority of the species are marine, but three or four genera and numerous species inhabit our fresh-water. The writer has long entertained the hope of adding something substantial to the knowledge of the American species, but being reluctantly obliged to relinquish the hope feels bound to place the few incomplete notes collected at the disposal of others. A month's systematic study of our fauna in a favorable locality would double the number of species here mentioned. It is not unlikely that the modern *Branchiopoda* and *Cladocera*, had their origin as off-shoots of this group either independently or, more probably, the latter meditated by the former. A gradual progression is seen in the Ostracoda from a nauplius-like creature to a highly complex organism with lamellar post abdomen and bi-ramose second antennæ similar to certain Cladocera. The order may be divided into two groups in one of which the second antennæ are simple, in the other biramose. The latter includes the suborders Myodocopa, Cladocopa, and Platycopa, all marine, while the former constitutes the suborder Podocopa containing the families Cypridæ, Darwinellidæ and Cytheridæ, with the first of which alone we are at present concerned.

FAMILY CYPRIDÆ.

Anterior antennæ simple, adapted for swimming, setose; second antennæ sub-pediform, clawed; mandibles toothed, palpate; first maxillæ with a branchial plate, second with or without branchial plate; feet of two pairs, first directed forward, clawed, second turned backward and upward, feebly armed; abdomen ending in narrow rami, clawed, or spined apically, sometimes nearly rudimentary. About ten genera are known, of which four are found in fresh-water, and but one of which occurs in the fresh waters of America.

Genus Cypris.

Shell horny, more or less reniform or oval. Anterior antennæ 7-jointed, lower pair 5-jointed, the former with long setæ used for swimming, the latter bearing on the apical and penultimate segments serrated claws as well as setæ; second maxillæ prehensile in the male; post-abdomen consisting of two slender rami with one or two terminal claws. In some species of the genus Cypris the females reproduce parthenogetically and males rarely appear, while in closely allied members of the same genus sexual reproduction is the rule, a fact very instructive in interpreting the remarkable conditions prevailing among the Cladocera. The organs of reproduction are obscure and have long been misunderstood. Indeed the ostracoda were long believed to be hermaphrodites. The careful experiments and observations of Zenker and Wilhelm Mueller have placed us in possession of the salient facts, though a great deal remains to be done in the line of detailed study like that given by Weismann to the Cladocera. Instead of giving a detailed account of the anatomy of the genus the reader is referred to the description of *Cypris virens*, prepared by Mr. J. L. Deming, who first identified the species in Ohio and carefully studied it. The species is typical and is the most generally accessible type of the group. Such a detailed description will also lighten the burden of subsequent descriptions.

Cypris virens, *Jur.*

(Plate VI, Fig. 3.)

This fine species is widely distributed in America as well as Europe. It has been claimed by some that the identification of European Entomostraca in America was the result of careless observation or rash assumption. This has been fully disproved in the case of the of the other groups, and it remains to test the Ostracoda also. It would appear that our American fauna stands al least in very close relations with that of Europe. To determine whether there exists an actual identity of species, Mr. J. L. Deming, at our suggestion made a detailed and careful study of the American animal and found the camera drawings of the shell of the European to exactly coincide with similar outlines of our own. We have secured permission to use the description which he prepared and read before the Denison Scientific Association, to still further illustrate this agreement. The figures of this species are also in great part from Mr. Deming's drawings.

"Valves sub-reniform, the two ends almost equal, the dorsal side evenly curved, the ventral side sinuated, highest in the middle. The valves are covered with minute hairs. The hinge line is sinuated and unbroken. The outer part of the shell is slightly lined. The shell as seen on end, is oval; seen from above, oblong-ovate. Lucid spots, about seven in number, are to be found in about the center of the valves; these are oblong and irregular in shape, often pointing toward the ventral margin. Isolated spots are found near the dorsal side. The color is olive or yellowish green, with dark-brown spots near

the dorsal margin and scattered throughout the shell. A dark blue or almost black spot near the dorsal side and forward half of the shell indicates the position of the eye. The first antennæ, situated just in front of the eye, consist of seven joints; on the middle of the first joint is a short sensory filament; at its juncture with the second joint are three more. The fourth and fifth joints each bear four almost equal filaments. The sixth and seventh joints each bear three unequal filaments; all are plumose.

The second antennæ, situated just below the first, have five joints, the second joint with one long filament and a small sensory filament; about the distal quarter, from the body, of the third joint are six filaments, five of which are of equal length, much plumose; on the sixth a short one found on the outside, not plumose; on the inner side and near the junction is one long, thick filament. In the middle of the fourth joint are four short and one somewhat longer filaments; at the junction with the fifth are four unequal barbed filaments. The fifth joint, also, ends in four unequal barbed filaments.

At the base of the second antennæ is situated the mouth surrounded by the labrum which forms the roof. This is divided into two parts, the basal or that part inserted in the body, and the distal part or movable lip. The distal portion is divided into four plates, two lateral and two medial. The lateral plates are slightly fringed and at the distal end are divided to give room for the two medial plates, which bear upon their inner side two small barbed hooks, each provided with a fringed plate. (See fig. 1, plate 36, Brady's Monograph of British Ostracoda.) Below this is a pair of powerful mandibles, armed at the distal end with nine spine-like teeth, in the middle bearing a four-jointed palp. The first joint of which bears a branchial plate and three or four plumose spines; the second joint at the distal end, seven filaments and one plumose spine; the third joint on the distal third bears four long filaments and at the junction, four others; the fourth joint is armed with three somewhat long claws. Two pairs of maxillæ; the first large and divided into four digital branches, the anterior branch being larger than the rest and two-jointed; attached to this is a large branchial plate. The second maxillæ are smaller, conforming strictly to the generic types, the distal end bearing about ten short spines and and an appendage armed with two long and one somewhat shorter spines; at its middle also provided with a branchial plate. Two pairs of feet; the first stout and five-jointed, terminated by a long, curved claw, bearing upon each joint a single filament. At the base of the claw are two short spines, one on each side.

The second pair more slender and usually bent upwards within the valves; each is terminated by a short; stout, curved claw, and two filaments of about the same length; the third joint bears three short filaments, one at the base and one in the middle, and one at the distal end; the fourth joint has but one, found at the distal end.

The post-abdomen forms two long, movable rami, which are well developed and terminated by two claws of unequal length, and in fine specimens are serrated on their inner edge toward the apex. The rami themselves are also serrated. The short seta on the inner margin of the ramus is not far removed from the claws. The eye is single and simple, marked by a black spot on the dorsal forward half of the body. The alimentary canal is composed of only two pouches, the first forming the stomach, the second the intestine; these lie near the dorsal side.

In the female the ovaries are situated just beneath the shell, while the mucilage

glands are situated on each side of the rami. The function of these glands is supposed to be that of secreting the fluid for forming the shell.

It has been with much patience and great difficulty that I have succeeded in obtaining the male of this species. In it the mucilage glands are of the same structure as those of the female. The copulative organs are situated immediately in front of the post-abdominal rami, and are provided with testes of complex structure. On account of the scarcity of this sex, I have been unable to make a complete study of the male organs."

Cypris dugesi. *sp. n.*

(Plate VI, Fig. 7.)

Closely related with Cypris virens, with which it exactly agrees in form. Length 1.30 mm., height .80 mm. As viewed from the side, oblong-reniform, dorsal margin nearly evenly rounded, but most convex behind, ventral margin moderately sinuous; higher posteriorly than in front; viewed from above, narrowly oval, acute at both ends, the greatest thickness back of the middle. Valves smoothish, yellow or fuscus. Lucid spots irregular, elongate, few.

Anatomy closely resembling C. virens. First antennæ with long, somewhat plumose setæ; longest terminal seta over .32 mm. long; joints of antennæ, beginning with the last, measure, .04 mm., .05 mm., .056 mm., .072 mm., .08 mm., .06 mm. Terminal joint with two long and two short setæ, penult joint with five or six setæ of varying length, three of them being very long, anti-penult segment with two long setæ above and two shorter ones below, fourth segment similar, second and third each with two minute setæ, basal segment stout, with one or two small setæ; none of the setæ pectinate. The second antennæ are stout and rather short, the terminal joint .04 mm. long and conical in form, bearing three toothed claws .15 mm. long and two small spines on the apex; the following joint is .16 mm. long snd bears two terminal toothed claws about .20 mm. long and three longer setæ, while before and behind about midway are two small setæ; the third joint from the apex bears six long setæ extending beyond the terminal claws, and one smaller spine on the apex and a sensory club and seta midway behind; the next two joints each have two setæ at the apex.

The jaws are strong and armed with lobed or digitate teeth, the palpus being rather larger than usual. The branchial plate of the maxillæ is elongated.

The terminal claw of the first pair of feet is as long as the whole limb. The second pair of legs are armed at the end with a short claw and a seta. The caudal stylets are about .30 mm. long, armed terminally with a long claw .16 mm. long and a weak spine .06 mm. in length, a second claw springs from the dorsal side a short distance from the end and is .12 mm. long, and a fourth appendage is in the form of a small seta .08 long, about .20 from the base and dorsally situated. This species was founded on specimens collected by Prof. A. Duges, in Guanajuata, Mexico, and by him sent to the National Museum, where they are numbered 9,291.

From C. virens it differs in the armature of the limbs as well as in size, but may prove a variety. The number and relative length of setæ of the first antennæ may prove

of questionable value in identification. The following points also serve to distinguish it from the species identified with the European C. virens. The post-abdominal rami are not serrate behind, the setæ are not pectinate, the anterior of the three one-jointed lobes of the maxilla has two pinnatifiid processes as well as simple stout spines.

Cypris altissimus, *Chambers.*

Undoubtedly this is closely allied with the above. It is said to closely agree with C. virens, but to be less distinctly reniform and more elongate, with extremities more nearly equally rounded. The antennæ are described as follows:

"There are two short setæ (one longer than the other) from the third joint; two short and two long ones from fourth joint; three long ones and one short one from the last joint. Color bright deep green."

The specimens come from a pond fed by melting snow on the side of Mount Elbert, Colorado, at a height of about 12,000 feet.

Cypris perelegans, *sp. n.*

(Plate III, Figs. 7–12.)

Carapace of largest size, elongate sub-oblong, sides nearly parallel, upper margin nearly straight, lower outline with two sinuses and two slight convexities, produced to form a slight tooth behind; greatest height at one-fourth the length from the posterior, equal to less than one-half the length; width greatest somewhat in advance of the middle, about four-tenths the length; color clear, pale yellow, with a well defined pattern in deep brown, pattern consisting of a sigmoid band crossing the middle of the valves, giving off spurs at each flexture, and sundry other spots, as well as an anterior marginal band; surface shining, minutely dotted, slightly hairy at the margins; lucid spots consisting of two large irregularly pentagonal approximated spots, with three smaller ones grouped below; appendages very similar to C. virens; antennæ seven-jointed, slender, basal segment very large, third elongated, four succeeding nearly equal in length, fourth and fifth segments each with two long setæ above, sixth with four long and one shorter setæ, apical segment with four very long setæ, fifth segment with two setæ of moderate length below; antennules slender, apical segment with two serrate claws and two slender setæ, fourth (antepenult) segment the same, third segment with four very long and two shorter setæ, second segment with six long pectinate setæ reaching to end of terminal claws; labrum with claw-like appendages bearing seven teeth, the inner being double, medianly the labrum appendaged with pectinate plates; the mandible furnished with six strong teeth, two pectinate setæ and several small spines, the palp being well-developed; second maxilla with short lobes, the anterior of the 1-jointed lobes with four very strong toothed spines; first foot with five segments, the apical one being very small and bearing a single very long serrated claw, the third and fourth are equal and much more slender than the second; second foot slender, apical segment with two small claws and

a delicate seta, caudal stylets elongate, narrow, serrate behind, with two straight, unequal serrate claws, lateral spine sub-terminal.

Length 3.60 mm., height 1.72 mm., width 1.40 mm.

This is perhaps the largest species of the genus and is our most beautiful form, the bright and contrasting colors of the valves and the definite pattern making it very conspicuous. Found in pools near Mobile, Ala., in great numbers in July.

Cypris minnesotensis, *sp. n.*

(Plate VII, Fig. 2.)

The description of this the American representative of C. fasciata, has been withheld for several years in the hope of securing other specimens. It is here given, imperperfect as it is, for the sake of collating all the information at hand. From any of the American species it is at once known by the great proportionate length of the valves which are about two and one-half times as long as broad. Lower margin nearly straight, gently sinuous near the middle, dorsal margin gently curved, highest back of middle, then gently curved; color light, with two inconspicuous dark transverse bands on either side at about the anterior and posterior thirds; scattered hairs upon prominences are found near the margins. Antennæ slender, seven-jointed, apex with two very long and one short spine, penult segment with four long setæ, antepenult segment with two long plumose setæ above, preceeding segment with shorter setæ; second antennæ with the apical segment very short and armed with one (?) serrate claw and a seta, the preceeding with two claws and a few short setæ, antepenult segment with three (four?) shortish setæ, not reaching end of claws; mandible with strong, lobed teeth and a large palp; first foot with a large claw; second foot slender, ending in a small hook with a single weak seta; caudal stylets rather short and wide with two strongly serrated claws, the other spines being obsolescent (?); posterior margin serrulated. Lucid spots of the shell seven in number, two being minute. Length of shell 1.6 mm. Several points require verification, but in connection with the drawings the above may serve to identify the fine species.

Cypris modesta, *sp. n.*

(Plate IV, Fig. 5.)

Shell sub-reniform, greatest height behind the middle, upper outline somewhat obliquely truncate, especially in the male; color yellowish, scarcely maculate, nearly smooth. Antennæ short, with long non-plunose filaments, two from the apical and four from the penult segment very long, others half as long; second antennæ with three toothed claws on the penult segment, one together with three smaller ones, on the apical, antipenult segment armed only with small bristles, preceeding one with six long setæ exceeding the claws; first foot slender, apical segment long conical, with a long serrate claw and a bristle, other setæ short; second foot (in the male) with a very short termi-

nal segment armed with two very long setæ and one shorter one; caudal stylets very slender, with a terminal claw, a sub-terminal claw somewhat smaller and a weak petinate seta one-fifth the length of the stylet from the end; palp of mandible very bristly. The intromittant organ of the male is more simple than those hitherto described, consisting of a broad, flat basal segment on either side, with a coiled ductus ejaculatorius and a funnel-shaped terminal portion consisting of two opposable flaps. The basal segment is indistinctly two-jointed and those of both sides are seated on a common prominence.

Length of male, 1.70 mm., of female 2.16; height of male, .84 mm., of female 1.24. The above measurements are too large, but express the correct proportions. It is one of the smaller species.

Cypris striolata, *Brady.*

(Plate IV, Fig. 3.)

"Shell broadly ovate; greatest height in the middle, equal to about two-thirds of the length. Dorsal margin strongly arched, sloping with a gentle curve toward the anterior, but with a bolder sweep toward the posterior extremity, ventral margin mostly somewhat convex. Anterior and posterior margins rounded, the former somewhat narrowed. Seen from above, the outline is compressed, oval, rather narrowed in front, the greatest breadth equal to less than half the length. End view oval. The surface of the shell is highly polished and marked by closely set longitudinal anastamosing striæ. Color dark brown. Length one thirty-third, height one-fiftieth of an inch." The setæ of the lower antennæ unequal, three being long; second foot with one long seta and two shorter ones; caudal stylets rather short, with two nearly equal claws near the end. .60 mm. long; widely distributed.

[Genus notodromas, Lilljeborg.]

There seems to be no longer sufficient reason for considering this genus distinct from Cypris, as none of the assumed generic characters are distinctive unless it be the form of the maxillæ. Comparing the second maxillæ in Cypris, Candona, and Notodromas, it is at once seen that there are only differences in the degree of modification. The pediform nature of these maxillæ seems in no sense of generic importance, neither are there peculiarities in the structure of the shell not seen in less extreme development in members of the genus Cypris. The eyes, however, are not confluent as in Cypris.

Cypris (Notodromas) monacha, *Mueller.*

(Plate IV, Fig. 4.)

Shell, in the female, sub-quadrangular, dorsal outline strongly curved, highest back of the middle, anterior and posterior margins meeting the lower line at an angle, passing into the upper one by a flowing curve, lower outline slightly convex, lower surface bear-

ing a squamous plate posteriorly on either side projecting posteriorly. Shell of the male similar, but the greatest height is near the middle and the posterior outline is very strongly convex near the middle, the lower and upper margins meeting at an acute angle. Lower antennæ with very short setæ upon the three last segments, the preceeding bearing six long, plumose setæ. The first foot terminates in two short and one long claw. The second foot is rather stout, bearing three sub-equal apical setæ. The mandibles are of the usual form while the maxillæ lack the palp in both sexes and are dactylate or pediform in the male. The caudal stylets are of moderate length, with two long sub-equal terminal claws and a lateral seta near the end behind. The species is found throughout the circumpolar provinces and is represented in the southern hemisphere by similar if not identical forms.

Genus Cypridopsis, Brady.

This genus differs from Cypris simply in the great reduction of the caudal stylets which become mere papillæ with long spines. Three species are recognized by Brady though several of the European forms described upon the basis of external form alone may prove to belong here. Two species are identified in America, one agreeing most nearly with C. aculeata of Lilljeborg, the other seemingly identical with the widely distributed C. vidua.

Cypridopsis hystrix. *sp. n.*

(Plate IV, Fig. 6.)

The American representative of H. aculeata of Lilljeborg, with which it may prove identical. If the figures given of the post-abdomen of that species are correct ours is certainly distinct. Length equal to about twice the greatest height which lies just behind the anterior third, anterior outline much higher than the posterior and evenly rounded, posterior margin acutely angular, lower outline slightly concave, upper margin twice angled; shell covered with long curved spines; color yellowish, with eight lucid spots. Antennæ slender, composed of seven segments, of which all but the basal are short and subequal, setæ not plumose, distributed as follows: to the apical joint two long and two short, to the penultimate four long, to the preceeding and the next following each two long and two short, to the still preceeding one long and one short. Antennules with very short apical segment with two strong unequal claws and a minute seta, penultimate with two equal toothed claws and a number of slender setæ, third from end with five long and several short setæ, preceeding segment large, with three slender setæ. First foot five-jointed, second joint elongated, third and fourth equal, each with a single short seta, apical segment small, with two setæ and a long toothed gently curved claw; last foot moderately slender, terminal joint with a small claw and two setæ at the apex and a lateral spine. Caudal stylets reduced to minute papillæ bearing a slender claw and a flexuous spine. The mouth parts bear the characters of the genus Cypris.

In this species there is an aureole-like lucid zone about the anterior of the shell and a similar, but triangular appendage behind.

This species may be regarded as forming a transition to Cypris proper, as the form if not the size of the stylets is more as in that genus.

Cypridopsis vidua, *Mueller* (?)

(Plate IV, Fig. 1.)

Cypris vidua, Herrick, Micr. Entomos.

If not the species quoted, certainly very similar is a small, greenish species distributed throughout the Eastern United States.

Shell ovoid, very tumid; greatest height in the middle, anterior extremity much the broader; ventral margin gently sinuous. As viewed from above, broadly ovate, acutish anteriorly and widest behind the middle.

Length once and one-third the width. The shell is so broad as to make it hard to secure a side view which is most readily obtained in other species, lateral diameter being considerable greater than height.

Shell nearly smooth, yellowish-green to pale, with three dark bands passing transversely, covered with fine hairs and punctuate. Limbs robust. Anterior antennæ seven-jointed; terminal and penult segments each with three (?) non-plumose very long setæ, third segment long, upper surface of first segment with two rather long setæ. Claws of the second antennæ strong, serrate, setæ of third segment longer than the claws. Second foot with a terminal straight seta and a curved claw, also a sub-terminal claw. Length 1.24 mm., height .80 mm., greatest width .88 mm., eye .22 from anterior, greatest transverse diameter intersects longitudinal diameter .06, back of middle. Eastern United States, rather common.

Genus Candona.

The animals of this genus resemble Notodromas in lacking the branchial plate of the second maxillæ, but differ from it and Cypris in lacking the setæ of the second antennæ, while those of the antennæ are short. Being destitute of natatory appendages, these animals content themselves with creeping and forging about in the mud upon the bottom. No species is accurately known from America, though that described in an early paper (Microscopic Entomostraca) as Candona ornata, seems to belong here and should be recognized by the sculptured free margin of the shell as well as the peculiar form. A species like C. albicans also occurs.

The following species are described by V. T. Chambers, which for the sake of collating the American forms, are here admitted.

Cypris grandis, *Chambers.*

Bulletin U. S. Geol. Surv. (No. ?) Art. IX.

"Valve oblong, slightly sub-reniform, highest behind the middle, sloping thence regularly toward the anterior end, with a slight bulge on the hinge-margin just where it rounds off in front. Greatest thickness about the middle. In side-view somewhat resembling Brady's figure of C. tessalata, but this species is longer in proportion to height and has the highest point of the dorsal margin a little further behind. Ventral margin very slightly emarginate. In dorsal and ventral view, somewhat resembling Brady's figure of Macrocypris minna. Right valve slightly overlapping the left; surface smooth, with minute punctures and short hairs, but with a group of scattered, large, sordid, yellowish punctures about the middle of each valve. Color, bluish-white, sometimes with pale greenish tinge. Basal joint of superior antennæ, with two short setæ above and one below, second joint with a single short one below, third with two short unequal setæ above and one below, fourth with two short setæ above and two long ones below, fifth as the fourth, sixth with two short setæ above and four long ones below, seventh with two long and two shorter setæ. Inferior antennæ with one moderately long and two short claws, and two setæ from the end of the last joint, and with four long claws (one shorter than the other three) and two moderately long setæ and one long one from the end of the penultimate joint. . . . Post-abdominal ramus similar to that of C. incongruens, as figured by Brady, but longer, having three unequal setæ, the terminal one longest. . . . . Length, one-seventh inch, height, one-twelfth, thickness one-eighteenth. Lucid spots indistinct, about nine, the two anterior obliquely transverse and long, the two posterior small. Abundant in ponds along the Upper Arkansas river, in the Mount Harvard region at an altitude of 8,000 feet."

Cypris mons, *Chambers.*

Bull. U. S Geol. Surv. (No. ?) Art. IX.

"Ovoid; tumid; highest immediately before the middle. Length, one-twenty-sixth inch, height one fifty-seventh inch. Dorsal margin regularly arched, sloping more rapiely behind the highest point than before it. Extremities rounded; the anterior widest; ventral margin very slightly sinuated. Seen from above, ovate, but less tumid than Cypridopsis vidua as figured by Brady. But little or not at all narrowed in front, widest a trifle behind the middle. Lucid spots, seven, near the middle of the valve; the three lower ones in a line and small; one of them very small. Valves white, shining, smooth, with numerous almost confluent punctæ. The setæ of the lower antennæ extend beyond the apex of the claws, and the articulate appendage of the third joint has its apex swollen or enlarged. Superior antennæ with two long and one short seta from the end of the fourth joint; two from the end of the fifth joint; four long ones from the end of the sixth; two long and two short from the end of the seventh. The last joint of the inferior antennæ is small, almost rudimentary, bearing a single large claw. (Indeed it seems to be bifid with a claw from each branch.) There are three other claws articulated to the end of the penultimate joint, from which also arise four setæ shorter than the claws. . . . . Abdominal rami straight, slender, each with two claws, one under the other. Pond on Mount Elbert; altitude about 11,000 feet."

The following species are perhaps too imperfectly described to trouble synonomy.

C. agilis, Haldeman, Proc. Phila. Acad., 1841.
C. discolor, Haldeman, Proc. Phila. Acad., 1842.
C. hispida, DeKay, Nat. Hist. N. Y., VI, 1844.
C. neglecta, Herrick, 7th Rep. Geol. Minn., 1879.
C. scabra, Haldeman, Proc. Phila. Acad., 1842.
C. simplex, Haldeman, Proc. Phila. Acad., 1841.
C. vitrea, Haldeman, Proc. Phila. Acad., 1842.

ORDER CLADOCERA.

This large order of exclusively fresh-water shelled crustacea is quite well represented in Alabama, in spite of the absence of large lakes which afford the most suitable locations. In a small pool at Opelika, for example, a very large variety was noted. The Cladocera fauna of the south is characterized by the presence of several interesting intermediate forms not found at the north.

The order is composed of animals of minute size and, in spite of great variation in form, very obvious relationship. No doubt ever exists as to the right of a species to a place within the order. So abundant are these creatures that no standing body of fresh-water is long without some representatives. They may be recognized by the following characters. The body is covered, with the exception of the very large laterally compressed head, by a thin diaphanous shell, often beautifully striate or figured. The head is provided with a large compound eye, a small occular fleck which is but a persistent larval organ, a pair of small sensory antennules and a pair of large biramose antennæ, one ramus of which is three- the other four-jointed in most species. The mandibles are nearly cylindrical and are attached to the shell at the juncture of head and body. A pair of minute maxillæ follow and then from four to six pairs of variously formed feet. The feet are lamellate and serve a respiratory function. The body terminates in a flat toothed body, the post-abdomen, which may be regarded as the result of the combination of the two anal stylets of other crustacea. Sometimes this coalescence has involved with it the alimentary canal, at other times not, so that the anal opening varies greatly in position.

The internal organization is very simple and is easily studied because of the transparency of the body. Without expatiating on anatomical and systematic details for which the reader is referred to special monographs, we pass to a description of the new or remarkable species encountered in Alabama.

The normal or calyptomerous cladocera are divided into two sections of which the *Ctenopoda* are regarded the highest. The species of this group have six pairs of feet and an elongate graceful body. The family Sididæ, represented by the ubiquitous *Sida crystallina* is the only one represented in Alabama.

Two species of Daphnella and one of Sida are widely distributed, and near Mobile occur the curious intermediate form described beyond.

Genus Pseudosida. Herrick.

In appearance very similar to Sida, but rather more slender than either species, though very similar to Sida elongata; antennules of the female with a long flagellum like that of the male in Sida; antennæ with the outer (longer) ramus two-jointed, with numerous setæ, while the inner ramus is three-jointed and has but few setæ, terminal segment short; post-abdomen armed with groups of short spines. The antennæ are like

those of Latona in reversing the usual relation of the rami, as are also the elongate antennules in the female.

Pseudosida tridenta, *Herrick.*

(Plate III, Fig. 2–5.)

P. bidentata, Herrick, Final Report. (By oversight the number of caudal teeth was misstated and the name made to correspond.)

Head very short, acute below, the beak bearing in the female a pair of rather large antennules which are armed with a pectinate process three times the length of the antennule, and a cluster of about five sensory setæ. The antennæ are as long as in Sida and well armed. The basal joint of the two-jointed branch bears seven setæ, the second ten setæ of which two are apical; three-jointed ramus with very short basal segment, second four times as long as wide and armed at the end with two setæ and a spine, third segment very small, with three setæ and a minute spine. The maxilla is two-jointed the terminal joint bearing nine jointed spines or short setæ. The first foot of the adult female is biramose, the outer ramus being large, its terminal joint bearing seven pectinate processes, the preceeding segment has two processes on tbe outside, while the short basal joint has a very large process, the outside of the base of the limb, with three similar processes, inner ramus with five setæ on the third and four each upon the second third, inner margin of base of limb produced to form a multisetose branchial fin. Post-abdomen rather small, its terminal claws short and armed with three basal spines and a series of spinules along the inside, post-abdomen also ornamented with about twelve clusters of teeth along the posterior margin and about the base of the claws. The egg-stalk is long and about three out of every four eggs produced parthenogetically serves as nourishment for the fourth, the ephippial females (i. e. the late females which produce eggs coated to resist cold or drouth) are smaller than the ordinary examples and produce two very large ova.

Family Daphnidæ.

This family may be recognized by the presence of but five pairs of feet, the last pair being smaller than and distant from the others; antennules small, antennæ cylindrical with a three- and two-jointed ramus, the former with five, the latter with four setæ, intestine simple.

The genera Daphnia, Simocephalus, Scapholeberis, Ceriodaphnia and Moina are all represented and a new genus which fills very fully the gap between Moina, the least dif-

ferentiated, and Daphnia one of the more highly differentiated genera. The relation between the genera may be gathered from the accompanying key.

I. Head with a beak, but with rather short antennules
  * Shell angled or spined above the middle of the posterior margin.
    † antennules small, immovable, without lateral process
      1. *Daphnia.*
    †† Antennules movable, with a lanceolate lateral process.
      2. *Simocephalus.*
  ** Shell salient, or spined at the lower posterior angle.
    3. *Scapholeberis.*

II. Head without a beak, antennules movable.
  * Abdomen with dorsal processess to retain the eggs.
    † Shell oval, with hexagonal markings.
      4. *Ceriodaphnia.*
    †† Shell quadrangular, indistinctly marked.
      (Gen. nov.) 5. *Moinodaphnia.*
  ** Abdomen without dorsal processes.
    6. *Moina.*

Genus Moinodaphnia, gen. nov.

Head strongly arched above, angled in front, with almost a beak behind, antennules long, movable, as in Moina, antennæ with a long, unjointed spine on the apical joint of four-jointed ramus, body quadrate, merely slightly angled above; post-abdomen long, with the bifid spines characteristic for Moina, above provided with two evident processes for the occlusion of the brood sac.

Moinodaphnia alabamensis, *sp. n.*

(Plate III, Figs. 13-16.)

This remarkable species is worthy of special attention in as much as it not only furnishes a missing link in this large family, but forms a tie with the fauna of the southern hemisphere. In *Moina macleayii* of King, from Australia, we have a closely allied form which must be separated from Moina and included in the present genus. Our species, it can hardly be doubted, is a waif from the fauna of the far South, emphasizing the suggestions elsewhere observed of the transitional nature of the Alabama carcinological fauna.

In size this species agrees with the common Moina, being about 1.68 mm. long. The head is produced in front of the rather large eye, fornix somewhat developed, macula with pigment evident, beak considerably developed, antennule long, with a small filament above the middle in front and four feathery apical setæ, antennæ long, apical joints of both rami with a long, unjointed spine, that of the four-jointed ramus nearly as long as the setæ, seta of basal joint of other ramus elongate, labrum large. The post-abdomen is long, but is normally enclosed within the valves, terminal claw weakly spinulous, post-abdominal spines twelve, lower one bifid. Post-abdomen above with a strong,

curved, hairy process and a rounded prominence, above. Legs five pairs, normal. The whole habitus is as in Moina, but the form of the shell, especially the head tend evidently in the direction of Daphnia. Estuaries of Mobile Bay.

Genus Simocephalus.

Simocephalus daphnoides, *Herrick.*

S. daphnoides, Herrick, American Maturalist, 1883.

Reference is here made to this interesting species because of its bearing on the suggestions elsewhere made of the transitional character of the southern fauna. We have in this species a complete link between Simocephalus and Daphnia, just as we see in Moinodaphnia such a link with Moina. This species is as large as, and much of the shape of Daphnia pulex (over one-tenth inch long,) head very small, depressed and rounded, bearing the eye in the very front, lower margin straight, beak not produced, pigment-fleck small, oval or irregular, fornices small and short, antennules small, with a long sword-shaped spine near the base. Body oval or sub-quadrate, highest near the middle (not posterior to it as in other species) shell with a blunt spine near the middle and finely marked with anastamosing striæ, not armed with a group of modified spinules at the lower posterior angle. Post-abdomen narrow, very much as in Daphnia, armed above with two slender processes for occlusion of the broad sac.

Genus Scapholebris.

This genus stands rather more isolated than either of the others and yet there are not wanting evidence of near relationship with Ceriodaphnia and Simocephalus. In Alabama three species are known, one of which is not found abundantly north of the Tennessee river. The others are widely distributed. The head is depressed, short, and the continuation of the fornices runs toward the apex of the incurved beak, which commonly lies within the valves of the shell. The lower anterior angle has a prominence and there is a basin-shaped area inclosing the base of the antennæ, part of which lies on the shell and part on the head. This area is more strongly lined or reticulated than the rest of the shell. The lower margin is straight and terminates, in most forms, in a long scythe-shaped spine which is directed backward. The shell itself is usually indistinctly reticulate or unmarked, and commonly is deep colored. The post-abdomen is very like Ceriodaphnia or more as in Simocephalus; the anal spines are few and the older specimens have more than the young; the place at which additional spines are to appear is marked by prominences. The eye is of moderate size, the pigment fleck rather small and the antennules short, and hidden by the beak. The antennæ are of small size and generally dark colored. The ephippium contains but one egg; the males do not have altered antennæ or feet. The sexual periods fall in early summer and in autumn, ac-

cording to Weismann, and the males appear but sparingly. The species S. mucronata is very abundant everywhere, while the others are less frequently seen.

Scapholeberis armata, *Herrick.*

Scapholeberis mucronata, var. armata. HERRICK. Am. Naturalist, 1883.

A very beautiful and unique species, which possesses the extreme development of the peculiarities of the genus. The head is shaped very much as in the previous species, the fornix is squarish, the basin for the antennæ is small. The upper lines from the fornix meet behind the eye; the form of the shell is as in the above, but the spines upon the lower margin are longer. The scythe-like spine on the lower angles of the valves is extremely long, falling little short, in extreme cases, of being as long as the entire lower margin, in others about one-half as long. There are the usual lines parallel to the lower edge of the shell. The specimens having the longest spines were found in fresh water about Mobile, Ala., but the species occurs in Minnesota and intermediate points, though sparingly.

It is beyond question that this species is of southern origin. It was noted in 1883, that the spine of southern specimens average longer than those of the north. Moreover, Gay describes a species from Chili, under the name of *Daphnia spinifera* which, as nearly as can be gathered from Schoedler's epitome, is almost identical with *S. armata.*

It seems quite certain that the three nominal species S. nasuta, Birge, S. angulata, Herrick, and S. aurita, Fischer, are local or other conditions of one species characterized by the more or less complete absence of the posterior spines of the shell, in which case the latter name has the priority. The statement of Birge that the pigment fleck is long rather than nearly circular or squarish is either due to an oversight or the confusion of S. obtusa with the present species, though that species is not yet reported from America.

FAMILY LYNCODAPHNIDÆ.

The most abundant members of this family in Alabama are Macrothrix rosea and Ilyocryptus spinifer, the latter being apparently of southern extraction. The accompanying plate illustrates the structure of this anomalous genus and the relationship of the various species.

FAMILY LYNCEIDÆ.

The species most characteristic of the southern states is perhaps Lydigia quandrangularis, which is largely replaced northward by L. acanthocercoides. The American

genus Crepidocercus and the species Pleuroxus denticulatus and P. hamatus, P. affinis, P. unidens, P. procurvus, all are found abundant southward, thus adding evidence to that already adduced to prove that the United States is largely indebted to South America for what is peculiar to its fauna.

ORDER PHYLLOPODA.

Though obviously very closely connected with the Cladocera, the living members of this order form a rather homogeneous group in spite of great diversity of form. Great difference of opinion exists as to the origin of the group, some claiming for it a high antiquity, while others, like Packard, consider it a recent off-shoot of the Cladocera. The great number of similar segments found in the body of most Phyllopods may be taken, indeed, as a sign of inferiority, but it is doubtles inferiority due to degradation rather than the persistence of a primitive condition.

The appendages are two pairs of antennæ, jaws, two pairs of maxillæ and often a large number of foliaceous feet from which the order receives its name. Two well-marked sections are distinguishable, in one of which the whole or much of the body is encased in a bivalved shell, in the other the body is free and elongated as in Copepoda.

The species of this order are not only among the most beautiful of crustacea but are especially important in the light of their physiological peculiarities. In this group the variability of the form of the body under changing physical conditions has been most aptly illustrated. A change in the saltness of the water being sufficient to produce a change in form adequate to rank as of generic importance. The greater number of species live in fugitive pools and it seems as though in many cases dessication is prerequisite to the hatching of the eggs.

For the most complete account of the group the reader is referred to Dr. Packard's monograph in Hayden's twelfth annual report, while an account of the development is given by the writer, in Vol. I, of the Bulletin of Denison University.

FAMILY LIMNADIADÆ.

Body covered by a bivalved shell, eyes contiguous, first antennæ minute, second antennæ biramose.

Genus Limnetes.

Limnetes gouldii, Baird. Probably not rare in northern Alabama.

Estheria compleximanus, Packard.

Estheria mexicana, Claus. The existence of these two species is inferred merely from their known range.

FAMILY BRANCHIPODIDÆ.

Genus Streptocephalus, Baird.

The largest and most interesting species of the genus is

Streptocephalus sealii, *Ryder.*

(Plate VI, Fig. 2.)

which occurs throughout the eastern and southern states. These are very beautiful animals, brilliant in color and graceful in motions. They are abundant in pools of northern Alabama and also about Mobile, where myriads were seen with Cypris perelegans. Several stages in the development were observed, showing that the animals do not take on the final form for some time after they are sexually mature. The caudal stylets of the male form the most perfect possible clasping apparatus, being thorny instead of clothed with weak pectinate hairs, as in the female. This is the more remarkable as the antennæ as conspicuous examples of clasping organs as can be imagined.

Genus Chirocephalus, Prevost.

Chirrocephalus holmani, *Ryder.*

The young of this species was found with Streptocephalus in northern Alabama.

CRUSTACEA TETRADECAPODA.

(Fourteen-footed Crustacea.)

ORDER ISOPODA.

(The Pill-bugs.)

The Isopoda are well represented in Alabama, but are as yet quite unstudied. The collection made by the writer has been mislaid and the only data available are the drawings reproduced in Figs. 8-9, of Plate V.

Genus Asellus, Geoff.

First pair of feet chelate, last thoracic legs not elongate, first two pairs of abdominal appendages in male and first pair in female lamellate, small, caudal stylets elongate, mandible with a palp.

Asellus communis, Say, undoubtedly occurs in Alabama, perhaps also other species, especially in caverns, would reward the student.

Genus Mancasellus, Harger.

(= Asellopsis.)

The genus differs from Asellus in lacking the mandiblar palp and in the proportions of the body.

Mancasellus, *sp. n.*

(Plate V, Fig. 8.)

The species is known only from incomplete drawings and while closely allied to M. tenax, it seems to differ in proportions quite conspicuously. The lateral margins of the head are emarginated as in M. tenax, the segments are more closely associated than in M. tenax and the pleon is excavated in front on either side and is not truncate posteriorly as represented in M. tenax, but rather acute. The caudal stylets are short, about as in M. brachyurus, and the outer ramus is at least two-thirds as long as the inner. In M. brachyurus, however, the sides of the head are said to be entire. While unwilling to apply a name to so imperfectly described a species, we can not doubt that it is new, having been taken near Tuscaloosa, Ala. The small form figured in connection with the above is apparently a larva of some member of this genus. (Plate V, Fig. 9.)

ORDER AMPHIPODA.

The waters of the Gulf abound in members of this order, which also is represented in the rivers and pools. The "sand-hoppers" and "beach-fleas" may be sought among drift wood and weeds along shore. Some species may be found wedged in among the foliage, while others hop about upon the shore, and still others swim freely. The genus Allorchestes, represented by the *A. dentatus* so abundantly in the north, seems rare, though specimens were seen in the northern part of the state, if memory can be trusted. The genus Gammarus is well represented southward, while a much greater variety of forms inhabits the brackish waters. The two species described beyond are the only ones represented in our collections, though a species of Orchestia, like O. *palustris*, occurs in myriads in Mobile bay.

Gammarus mucronatus, *Say.*

(Plate IV, Fig. 1.)

Gammarus mucronatus. Say, Journ. Acad. Phila., I, part 4, p. 376.
Gammaracanthus mucronatus, Bate, Cat. Amph. Crust. Brit. Mus , p. 203.
(?) *Gammarus semicarinatus*, Bate, loc. cit. p. 204.
Gammarus mucronatus, Smith, Rep. U. S. Fish Com., 1871–1872, p. 559.

This peculiar species was described by Say, in 1818, but seems to have been constantly misunderstood. It was figured by Bate, from specimens of doubtful origin under a new name. From any species known to the writer it can be distinguished by the sharp spinous processes of the dorsal margin of each of the first three abdominal segments. Bates' specimens had the last thoracic segment carinate also. This may be sometimes the case in our species, though not in observed specimens.

Description of female. Length about eight centimeters, rather graceful; eyes elongate, sub-reniform; upper antennæ over half as long as body, flagellum considerably longer than peduncle, over fifteen-jointed, secondary flaggellum short, three-jointed; lower antennæ much shorter, flagellum seven- or eight-jointed, peduncle longer than that of first antenna, the second segment being longest; first leg shorter than second, propodos oval, twice as long as broad, palmar portion indistinct, dactyl curved, rather short; propodos of second leg about the same size, but obovate and obliquely truncate; natatory legs long; the sides of the second and third abdominal segments produced and toothed below these segments with the first carinate above and produced backward into strong acute spines much more prominent than in Allorchestes dentata; sides and top of the fourth, fifth and sixth abdominal segments with the usual clusters of spines; base of pleopod of the fourth abdominal segment very long, rami of all pleopoda unequal, spinous; divisions of telson slender, spiny tipped.

Gammarus (Gammarella?) dubius, *sp. n.*

(Plate VI, Fig. 1.)

Two imperfect specimens, apparently from the Gulf of Mexico, differ from the genus Gammarus in several respects.

About 14 mm. long; compact; eyes circular, antennæ long, with very stout basal joint; peduncle rather short, flagellum (unknown) probably of moderate length, secondary flagellum very short, two-jointed; lower antennæ with long peduncle; coxæ of anterior limbs moderately expanded; gnathopoda subequal, anterior propodus quadrate, large, strongly armed upon the palmar surface, with a strong spine above the base of the strong dactyl; second propodus similar, palmar surface oblique, armed as in the preceeding; legs sub-equal; pleopoda very spiny, short, basal joint of second pair very short and broad, third pair uni-ramose, terminal joint sublamellate; telson apparently double, but really single, with two quadrate portions twice as long as wide, separated by a deep incision; abdominal segments without tbe spines characteristic of Gammarus. It seems probable that this species should belong in Melita or Gammarella, but it differs in not having the quathopoda unequal. The species is variously banded and ornamented.

CRUSTACEA DECAPODA.

(Ten-footed Crustacea.)

ORDER BRCHYURA.

(Crabs.)

GENUS CALLINECTES.

Callinectes hastatus, *Ordway.*

This common species is known in the South as the "sea crab," and is identical with the "blue crab" of the northern markets. It is abundant upon the sandy shallow shores of Mobile bay, where many "crabbers" may be seen armed with scoop-net and bag almost any pleasant morning. It does not fear fresh water. The spawning season extends through the greater part of the summer. The species is not only the most important and abundant, but also the most active of the southern crabs. It feeds upon small fish and also acts as a scavenger, devouring greedily decaying refuse. Crabs are caught by angling or trolling with a bit of meat or by dipping with a net from shallow water. Twice as broad as long, with very acute lateral spines with eight smaller ones on the antero-lateral margin of each side. Color green, with blue upon the claws.

GENUS PANOPEUS.

Panopeus herbstii, *Edwards.*

The mud crab is probably found along the gulf coast, though none were gathered by us.

GENUS MENIPPE.

One or more species of stone crab is known to exist along the shores of the southern states.

GENUS EUPAGURUS.

Eupagurus longicarpus and probably other species of hermit crab may be sought in empty gasteropod shells.

GENUS PLATYONICHUS.

Platyonichus ocellatus, *Lalreille.*

The lady crab is also found in the waters of the Gulf of Mexico. It may be distinguished from the sea crab by being much narrower, not much broader than long. The front lateral margins have five spines, front with a three-spined rostrum.

FAMILY GRAPSIDÆ.

The little crabs of this family are chiefly found along shore and in brackish estuaries in the temperate zone. In general appearance they much resemble the fiddler crabs with whom they consort. A few forms are pelagic and may be encountered far out at sea.

The carapace is subquadrate, flattened; frontal plane broad; antennules transversely plicate; epistome short, meropodite of external maxilliped bearing the palp at the exterior angle or upon the apex; second joint of the abdomen of the male nearly as wide as the adjacent portions of the sternum.

The sub-family Grapsinæ contains such species as have the antennæ covered by the front of the carapace.

Genus Sesarma, Say.

(Plate V, Fig. 3.)

This is an enormous genus still very perplexing in the confused synonomy. The species are scattered over the whole globe, at least exclusive of the polar regions.

Carapace quadrate, nearly plane above, anterior margin excavated for the eyes at the angle, lateral outline straight, posterior outline excavated for the bases of the limbs of the fourth and fifth pairs; antennæ not cut off from the orbit, eye peduncles short, outer maxillipeds with an oblique hairy ridge crossing outer surface of the ischiopodite and meropodite, the latter rounded apically and elongate.

It has been thought best to carefully describe the species common in Mobile bay, even though the name properly applicable may remain in doubt.

Upper surface of the carapace little broader than long, proportions the same in both sexes; proportions as illustrated by the following measurements of an adult female. Width 23 mm, length 21 mm, width of unemarginated portion being 11, distance between orbits 11, free lateral magin 13, distance from anterior margin to base of cheliped 10, length of abdomen of female 16, width 19, length of eye peduncle 4.5 mm. The carapace ornamented by impressed lines and purplish splotches upon the olive brown of the general surface; pattern of impressed lines enclosing an oval space in front of the

middle produced into a very acute prolongation anteriorly with lines passing obliquely outward and forward as well as others posteriorly. Front abruptly deflexed. Gill cover rhombic, finely sculptured and pustutose, with minute spines, distant from median line in front 3.5 mm. Antennules minute, with the basal portion (probably representing combined coxocerite and basicerite), excavated tc receive the four-jointed endocerite, the terminal joint or protocerite being in the form of clawfitting into the penultimate segment of carpocerite.

The antennæ are also minute and are enclosed by a basin opening into that of the orbit. The basicerite bears a blunt mallated scaphocerite, with its brush of long and dense setæ. The ischiocerite is large and also bears a tuft of setæ, the remainder of the endocerite being in the form of a multiarticulate flaggellum. The jaws are rather small, the maxillæ are of the usual form, the maxillipeds being more characteristic. Of the latter, the second or outer pair has a strong coxopodite bearing a long lamellate plate (the epipodite) and a pair of well-developed gills while the gill-cover (epipodite) has a small rudiment of a gill. The basipodite is small bearing the slender palp or exopodite, the basal joint of which reaches only to the middle of the second joint of the inner limb. The latter, or endopodite, is long, with an irregularly pentagonal ischiopodite and a long, narrowly oboval meropodite, both these segments being crossed by an oblique hairy ridge. The three following joints are small and setose, the terminal one, or dactylopodite, being very small and oval. The chelipeds differ little in the sexes, being alike on both sides. Those of the male have the hands relatively thicker and hence the under outline more curved and the finger abruptly flexed. The hand and the finger are simply punctate, while the opposible margins each bear three nearly equidistant teeth with intervening smaller ones. The carpopodite is not spiny. The remaining ambulatory limbs are armed with simple spines, nearly smooth. Abdomen of male elongate, narrow, pentagonal, with minute free fin, that of female broadly ovate or seven-sided, terminal fin set in emargination of fifth joint, short oval; abdomen covering free sternæ completely in the female. Second pair of abdominal appendages in the male simple, slightly curved, first pair tortuous, narrowed toward apex, emarginate.

FAMILY MACROPHTHALMIDÆ.

This family includes the well-known fiddler crabs, of which the best illustration is afforded by the common

Genus Gelasimus, Latr.

Carapace rhomboidal, much wider in front, eyes on long peduncles, male with the left (or right) chelliped much larger than the other.

Gelasimus vocator. *Martens.*

(Plate V, Fig. 4.)

= *G. pugnax*, Smith.

A careful comparison of specimens from Mobile bay with those distributed by the

United States Fish Commission as G. pugnax, reveals no differences. The southern specimens seem to attain a greater size.

The essential points in the description are the following: Carapace smooth, meropodite of larger male cheliped with tuberculate margins, carpopodite with an oblique tuberculate ridge passing from the lower margin of the thumb on the inside upward and backward, inner and outer surfaces pustulate, finger longer than the thumb, strongly curved apically, thumb straight, lower outline of entire hand nearly straight.

ORDER MACROURA.

(Shrimp-like Crustacea.)

FAMILY PALÆMONIDÆ.

(Shrimps and Prawns.)

This family is quite abundantly represented in the fresh and salt waters of the state. Unfortunately they have not been even superficially studied, the following forms being such only as have come under the observation of the writer.

From the crayfish the members of this family may be recognized by the compressed abdomen, which has no transverse channel and has free lower margins. There are but two pairs of chelate feet.

GENUS PALÆMON.

Carapace extended into a long, serrate, plate-like rostrum; antennules with two multi-articulate flagella, the inner being appendaged; mandible with three-jointed palp.

Palaemon ohionis, *Smith.*

It is possible that this species may be found in northern Alabama.

GENUS PALÆMONETES.

This genus differs from Palæmon most notably in the absence of the mandiblar palp. It is represented by at least two species in Alabama, one being as abundant in salt as the other in fresh water.

Palæmonetes vulgaris, *Stimpson.*

(Plate IV, Fig. 1.)

The common prawn is abundant among the eel grass of Mississippi sound and other

parts of the Gulf coast. The characters by which it may be recognized may be gathered from the figures. It is generally an inch or an inch and one half long and differs in no respect from typical Atlantic coast specimens with which compared. Compare the following species.

Palæmonetes paludosa, *Kingsley.*

(= P. exilipes, Stimpson.)

(Plate V, Fig. 5.)

This species was found near Tuscaloosa in great abundance and has been noticed as far south as Florida.

From P. vulgaris it may be distinguished by the elongated last abdominal segment, the short appendage of the antennulary flagella and the straight rostrum with seven or eight teeth above and two smaller ones below near the apex. The scale (scaphocerite) of the antennule is short and the first foot has a very short, bristly hand. The telson is spiny toward the tip.

FAMILY PENÆIDÆ.

The family is represented in America by two species of the genus Penaeus, which in external characters approaches Palæmonetes.

GENUS PENÆUS.

Penæus setiferus, *M. Edwards.*

(Plate V, Fig. 6.)

The common prawn of the fishermen is very abundant along the Gulf coast and its capture and sale for food forms a considerable business. The half-grown young are termed "shrimp" by dealers. The prawn is marketable from February to May, when it is likely it retires to shallow estuaries to spawn, the young or shrimp are ready for market by June, and are greatly prized.

The following description combines generic and specific characters and may be taken as a description of a female specimen of average size:

Entire length 14.5 cm., spine projecting beyond head 22 mm., length of thorax and spine 52 mm., lamella of antenna 23 mm., flagellum about 30 cm. or over twice the length of the whole body; longest leg 57 mm. or rather longer than thorax and spine; telson 2 cm., exopodite of tail-fin 24 mm., height of last abdominal segment 14 mm. The frontal spine is long and but slightly curved, its slightly expanded superior blade with about nine acute teeth, below with two teeth. The basal segment of the antennules is excavated for the reception of the eye and the peduncle of the latter and the excavation is guarded within by a curved lamellate "scaphocerite," the two succeeding joints are much smaller,

the second attaining the end of the frontal spine and bearing a short inner and longer outer flagellum, each being simple. In *Palæmonetes vulgaris*, the common prawn, the outer flagellum is palpate, and *Pandalus leptoceros*, the deep water shrimp, has no such evident scaphocerite. The tergite of the occular segment is distinct, the basal segment of the pedulcle being trapezoidal, the eyes very large and obliquely attached, not terminal as in Palæmonetes. Antennary lamella rather broadly ovate, forming an acute point, abruptly truncate within at the base and emarginated, basal segment of endocerite short, following one longer, together about one fourth as long as the lamella, terminating in an enormously elongate flagellum. Hypostome protuberant, triangular. Mandible with large rhombic lamellate palp and minute teeth upon the comminuting edge. The first maxilliped is of good size, the ischiopodite being very short and anchylosed with the basipodite, which bears the long, flat, multiarticulate and bristly exopodite, the meropodite is long and unsculptured, the three following segments being small and hairy. The lower maxilliped has an exopodite like that of the first maxilliped, but shorter. The ischiopodite of the limb is longer than the meropodite, the joints diminishing toward the end, which is not chelate. The first leg is shorter and has a minute exopodite and the ischiopodite over half the length of the second or meropodite segment and is chelate, the third leg is longest and similar to the second, the fourth and fifth are similar and not chelate. The five anterior abdominal segments are furnished with similar, biramose swimmerets, of which the inner ramus is always less.

The last (sixth) abdominal segment is very high and carinate above, its swimmerets being very powerful, the exopodite being exactly in size and shape like the lamella of the antenna, extending half its length beyond the telson, which is narrow, very acute, and deeply grooved above.

Penaeus brasilensis, *Latreille.*

This species was found in Mobile bay during July. This species may be at once distinguished from the preceeding by the fact that the frontal spine is continued backwards as a low crest to the posterior margin of the carapace. Total length of specimens 70 mm. Antennæ 120 mm., thorax and spine 25 mm., telson 10 mm., exopodite of tail-fin 12 mm. The antennules are shorter than in P. setiferus, the flagellæ, especially, being shorter; the peduncle of the antennæ very short, flagellum less than once-and-one-half the length of the entire body, antennary lamella as long as the spine. Chelæ of first three limbs nearly smooth, proportions of the limbs much as in previous species.

FAMILY ASTACIDÆ.

(Craw-Fish.)

Genus Cambarus.

1. *Cambarus advena*, Hagen.
2. *Cambarus alabamensis*, Faxton.

3. *Cambarus blandingii*, Hagen, *var. acuta*, Faxton.
4. *Cambarus clarkii*, Girard.
5. *Cambarus compressus*, Faxton.
6. *Cambarus diogenes*, Girard? (= C. obesus, Hagen.)
7. *Cambarus forceps*, Faxton.
8. *Cambarus girardianus*, Faxton.
9. *Cambarus hayi*, Faxton. (?)
10. *Cambarus immunis*, Hagen.
11. *Cambarus latimanus*, Hagen.
12. *Cambarus lecontei*, Hagen.
13. *Cambarus penicillatus*, Hagen. (??)
14. *Cambarus spinosus*, Bundy.
15. *Cambarus versutus*, Hagen.

For descriptions of these species the reader is referred to Walter Faxon's Revision of the Astacidæ, Mem. Mus. Comp. Zool., 1885.

ADDENDA.

Galigus americanus, *Dana and Herrick?*

(Plate I, Fig. 16.)

A young fish-louse resembling this species was secured far out in Mississippi sound, among plants. These animals possess many remarkable peculiarities, most noticable of which are the large sucker-like organs upon the front, once mistaken for eyes. The mouth parts are curiously reduced and the anterior limbs become claws for grappling the scales of fish upon which they are parasitic. The most complete account of the anatomy of this genus remains that prepared by Dana and Herrick, in 1838.

Corycaeus subulatus, *sp. n.*

(Plate I, Fig. 7, A and B.)

A species of this genus closely allied to C. varius, Dana, but apparently undescribed, occurs in the Gulf of Mexico. The body is moderateiy extended, the first segment of thorax about once and one-half the stylets. The third segment is greatly produced laterally. The abdomen is small and the stylets rather long even for the genus.

Antennæ of moderate length, six-jointed and armed with long setæ, there being two from the second joint and four from the sixth, while the others have one each, except the first, which bears a number of short ones. The second antennæ are well developed, the first segment in the male being short and quadrate, bearing two stout spines, the second is large, lamellate and variously excavated and toothed at its distal margin, the third joint is very short, but bears two rather short claws, the fourth segment is longer and carries

terminally a very long, curved claw and a short spine. In the female the second antennæ are smaller and less powerfully armed. The inner branches of the swimming feet are reduced, the terminal segment of the outer branch in the feet of the third pair bears two spines externally, one long and one short spine apically, and five setæ within. The inner ramus of the fourth feet is reduced to a process bearing two long setæ. The fifth feet are minute. The caudal stylets are armed with three terminal setæ and one outer lateral one not far from the end. The fact that Dana failed to distinguish the sexes makes it difficult to satisfactorily determine whether our species is new, especially from rather meagre observations.

CONCLUDING REMARKS.

The study of the limited number of species above quoted seems to justify us in assuming that the differences between the Entomostracean faunas of North America and Europe are to be accounted for not, as would be expected, by variations due to discordant evolution since the glacial period, but by the interpolation of species belonging to a South American fauna, which is gradually blending with the circumpolar fauna. If this be so, the theory that the Entomostraca reached their development before the glacial period and were simply caused to move southward and at its close to return, deserves consideration, though it may be nearer the truth to imagine that at the close of the period of active glaciation, the suddenly-created glacial lakes furnished just the arena necessary for the rapid evolution of this wonderful assemblage of closely allied animals which at first were generally distributed over the northern temperate zone.

Artificial Key for the Identification of

Alabama Crustacea.

Key to the Orders.

I. Less than one-fourth inch long, covered by a bivalved shell enclosing entire animal, which possesses few feet . . . . . *Order Ostracoda.*

II. Less than one-fourth inch long, body, except the head, enclosed in a bivalved, delicately sculptured shell, feet fewer than seven pairs. . . . . *Order Cladocera.*

III. Of small but not minute size, body enclosed in a concentrically-lined bivalve shell, or, except the head, in a thin shell, feet more numerous than seven pairs, foliaceous. . .
(One division of) *Order Phyllopoda.*

IV. Less than one-fourth of an inch long, body elongate, with slender abdomen terminating in two setose stylets, head with many-jointed one-branched swimming antennæ, eye single, abdominal segments without appendages, thoracic feet of five pairs. . . . . *Order Copepoda.*

V. Often longer than one-fourth inch, much as above, but with more than five pairs of swimming feet, antennæ not used in swimming. . . . (second division of) *Order Phyllopoda.*

VI. Animals small, enclosed in a calcareous carapace of several parts, permanently attached by carapace or otherwise. . . . . *Order Cirripedia.*

VII. Animals of moderate size (one-fourth to one and one-fourth inches long), fourteen pairs of walking limbs, two long pairs of antennæ, body laterally compressed, eyes sessile. . *Order Amphipoda.*

VIII. Much as above, but body depressed, only one pair of obvious antennæ, abdominal appendages often in the form of gill plates, eyes sessile. . . . . *Order Isopoda.*

IX. Head and thorax consolidated, covered by a carapace or buckler, eyes stalked, body more or less depressed, abdomen incurved and appressed upon the thorax, feet five pairs. . *Order Brachyura.*

X. Head and thorax consolidated as above, eyes stalked, feet five pairs, body laterally compressed, abdomen extended, used in swimming. . . . . *Order Macroura.*

Key to Families and Genera.

I. *Order Ostracoda.* [Only the Podocopa of Fam. Cyprıdæ.]

A. Abdomen terminating in two long, clawed stylets.

a. Shell more or less reniform or oval, second maxillæ with branchial plate.
(page 24) *Genus Cypris.*

b. Second maxillæ without branchial plate.

1. Second antennæ with long setæ, shell high and sub-quadrangular.
(page 29) *Genus Notadromas.*

2. Second antennæ with setæ shorter than terminal claws, shell elongate.
(page 31) *Genus Candona.*

B. Abdomen terminating in two very short stylets armed with a long seta.
(page 30) *Genus Cypridopsis.*

II. *Order Cladocera.*

SUB-ORDER I.—CALYPTOMERA [membrane-clothed.]

Body enclosed in a bivalve shell. Mandibles truncate below. Maxillæ distinct, spiny. Thoracic ganglia discrete.

Tribe I.—Ctenopoda.

Feet six pairs, similar, foliaceous, all distinctly branchiate.

Fam. 1.—Sididæ.

Swimming antennæ with two unequal rami, intestine simple.

FAM. 2.—HOLOPEDIDÆ, [extra limital.]

Swimming antennæ simple, elongate cylindrical (in the male prehensile), intestine with two lateral dilations.

TRIBE II.—ANOMOPODA.

Feet five [or six] pairs, the anterior pair more or less prehensile and destitute of branchiæ.

FAM. 3.—DAPHNIDÆ.

Rami of antennæ three and four-jointed, five pairs of feet, the last with a curved appendage guarding branchial sac; antennules of female short, one-jointed.

FAM. 4.—BOSMINIDÆ.

Six pairs of feet, antennules elongated, many-jointed. *Genus Bosmina.*

FAM. 5.—LYNCODAPHNIDÆ.

Antennules of female elongated, but one-jointed; intestine simple or convolute.

FAM. 6.—LYNCEIDÆ.

Antennæ with both rami three-jointed, intestine generally convolute, with abdominal but no anterior cæca, antennules not elongate.

SUB-ORDER II.—GYMNOMERA [destitute of covering.]

Body without, or nearly destitute of bivalve shell; feet not branchiate, spiny. Anterior thoracic ganglia in one mass.

FAM. 7.—POLYPHEMIDÆ.

Abdomen curved, terminating in two long stylets. *Genus Polyphemus.*

FAM. 8.—LEPTODORIDÆ. [Extra limital.]

Abdomen straight, ending in short claws.

KEY TO GENERA.

FAM. 1. SIDIDÆ.

a. Head rounded, not acutely beaked below, one ramus of antennæ two-jointed, other three-jointed. (page 33) *Genus Daphnella.*

b. Head beaked below.

* One of the rami of the antennæ with an expanded plate at the base, antennules large. *Genus Latona.*

** Neither ramus of antennæ with expanded plate.

† Head high, crested, post-abdomen smooth, ... *Genus Limnosida.*

†† Head not strongly crested, post-abdomen spiny.

1. Antennules of female small, truncate, two-jointed ramus of antennæ with few (five) setæ. (page 33) *Genus Sida.*

2. Antennules of female with a long flagellum, two-jointed ramus of antennæ with many [over 8] setæ. . . . . (page 33) *Genus Pseudosida.*

FAM. 3.—DAPHNIDÆ. (See p. 34).

FAM. 5. LYNCODAPHNIDÆ.

A. Intestine more or less coiled.

a. Intestine with anterior cæca-like appendanges.

1. Short, shell without a spine above. . . . . *Genus Streblocercus.*

2. Long, shell extending into a spine at the upper posterior angle. . *Genus Ophryoxus.*

b. Intestine without cæca.

1. Five pairs of feet, shell sub-rotund. . . . . *Genus Drepanothrix.*

2. Six pairs of feet, shell oblong. . . . . *Genus Acantholeberis.*

B. Intestine not coiled.

a. Four pairs of feet, antennæ with ten setæ. . . . *Genus Lathonura.*

b. Five pairs of feet, antennæ with eight or nine setæ. . (page 37) *Genus Macrothrix.*

c. Six pairs of feet, antennæ with eight setæ, shell not regularly moulted. (page 37) *Genus Ilyocryptus.*

FAM. 6, LYNCEIDÆ:

A. Intestine not coiled. . . . . *Genus Eurycercus.*

B. Intestine coiled.

a. Body somewhat elongate-oval or quadrangular.

* Head with a keel above.

† Post-abdomen longer than half the length of elongate shell, becoming more narrow toward the end. . . . . *Genus Camptocercus.*

†† Post-abdomen less than half the entire length of the elongate shell, of equal width. *Genus Acroperus.*

††† Post-abdomen about half as long as the short and very high shell. . *Genus Alonopsis.*

** Head without a keel above.

† Post-abdomen nearly round in outline, armed with very long stout spines, terminal claw with one minute basal spine or none; greatest hight of shell about equal to the posterior margin. . . . . (see page 37) *Genus Leydigia.*

†† Greatest hight of shell moderately exceeding that of posterior margin; post-abdomen more or less triangular, armed with bristles; sheli marked with hexagonal meshes.

(a) Head nearly horizontal, blunt; post-abdomen prominent in the anal region. *Genus Graptoleberis.*

(b) Head depressed, acute; post-abdomen excised near the anus. (page 38) *Genus Crepidocercus*

††† Post-abdomen more or less quadrangular, armed with one or two rows of small teeth on either side behind; terminal claws with one or two basal spines; hight of posterior shell margin usually less than the greatest hight of shell. (page 38) *Genus Lynceus.*

†††† Greatest hight of shell little less than that of posterior shell margin; post-abdomen terete; terminal claws very minute. . . . . *Genus Phrixura.*

††††† Greatest hight of shell more than double that of posterior margin.

(a) Eye and first foot normal. . . . . *Genus Chrydorus.*

(b) First foot with a claw which extends beyond the shell. . *Genus Anchistropus.*

(c) Eye absent, only pigment fleck used for vision. . . *Genus Monospilus.*

IV. *Order Copepoda.*

FAM. 1. CYCLOPIDÆ. Right and left antennæ modified (geniculate) in male, antennules not biramose, fifth feet alike in both sexes, two egg sacs. . . (page 13) *Genus Cyclops.*

FAM. 2. CALANIDÆ. Generally but one of male antennæ geniculate, antennules bi-ramose, egg sac single, fifth feet of male generally modified. . . . . (page 5.)

FAM. 5. HARPACTICIDÆ. Antennæ of both sides geniculate in male, short antennules with a one-jointed palp, fifth foot two-jointed, leaf-like, egg-sac single. . . . (page 18.)

III, V. *Order Phyllopoda.*

FAM. BRANCHIPODIDÆ. Body slender, thoracic segments distinct, eyes stalked, eggs carried in a sac beneath the abdomen. . . . . *Streptelocephalus, Chirocephalus, Etc.*

FAM. ESTHERIDÆ. Body wholly or partly enclosed in a bivalved shell, eyes sessile. Shell oval, sub-globose, without lines of growth, feet ten to twelve pairs. (page 38) *Genus Limnetes, Genus Estheria.*

VII. *Order Amphipoda.*

FAM. ORCHESTIDÆ. Upper antennæ shorter than lower, with no secondary flagellum, mandible not palpate. . . . . (page 40) *Genus Orchestia.*

FAM. GAMMARIDÆ. Upper antennæ generally longer than lower, with a secondary flagellum, first and second feet chelate.

1. Telson (tail-fin) double, last pair of feet bi-ramose, three clusters of spines on the posterior margin of the fourth, fifth and sixth abdominal segments. . (page 40) *Genus Gammarus.*

2. Telson single, last pair of feet with one ramus, clusters of spines absent. (page 40) *Genus Crangonyx.*

FAM. LYSIANASSIDÆ. Upper antennæ with a short secondary flagellum, only the first foot chelate, body little compressed. . . . . *Genus Pontoporeia.*

VIII. *Order Isopoda.*

FAM. ONISCIDÆ. Inner pair of antennæ obsolete, madible not palpate, last abdominal segment small. *Genus Porcellio, Etc.*

FAM. ASSELIDÆ. Inner pair of antennæ short, lower long, mandible generally with a palp, last abdominal segment large.

1. First pair of feet chelate, caudal stylets elongate, mandiblar palp absent. *Genus Mancasellus.*
2. As above, palp present. . . . . (page 39) *Genus Asellus.*

IX. *Order Brachyura.*

A. Large or medium sized aquatic crabs.

a. Posterior pair of limbs, paddle-like, for swimming.

1. Lateral margins of shell [carapace] extended into strong spine, carapace wider than long. (page 42) *Genus Callinectes.*
2. Carapace not much broader than long, lateral margins not generally produced. (page 43) *Genus Platyonichus.*

b. Posterior pair of limbs like the others.

1. Of large size, carapace oval, ... (page 42) *Genus Menippe.*
2. Rather small, carapace subpentagonal. . . . (page 42) *Genus Panopeus.*

B. Small crabs living in gasteropod shells. . . . . *Genus Eupagurus.*

C. Small crabs, not strictly aquatic.

1. One of the male claws [chelæ] greatly enlarged. . (page 44) *Genus Gelasimus.*
2. Male chelæ alike or nearly so. . . . . (page 43) *Genus Sesarma.*

X. *Order Macroura.*

FAM. ASTACIDÆ. Abdomen not laterally compressed, carapace with a transverse channel, united with the epistoma, gills filamentous, three pairs of feet chelate, the first being largest, rostrum flattened from above. . . . (page 47) *Genus Cambarus.*

FAM. PENAEIDÆ. Abdomen laterally compressed, carapace with no transverse channel, three pairs of feet chelate, the first not greatly enlarged, rostrum generally laterally compressed, serrate. . . . . (page 46) *Genus Penæus.*

FAM. PALÆMONIDÆ. Abdomen laterally compressed, carapace unchanneled, gills composed of plates, third pair of feet not chelate, rostrum generally laterally compressed, serrate.

1. Rostrum short. . . . . (page 47) *Genus Crangon.*
2. Rostrum long, laterally compressed, mandible with a three jointed palp. (page 45) *Genus Palæmon.*
3. Rostrum as above, mandible not palpate. . . (page 45) *Genus Palæmonetes.*

DESCRIPTION OF PLATES.

Plate I.

Figs. 1, 2. *Acatia gracilis*, Herrick.
Fig. 3. *Temorella affinis*, Poppe.
Fig. 4. do. fifth foot.
Fig, 5. do. jaw with palp.
Fig. 6. do. antennule.
Fig. 7. *Corycœus subulatus*, Herrick.
Fig. 8. *Pseudodiaptomus pelagicus*, Herrick.
Fig. 9. *Calanus americanus*, Herrick.
Fig. 10. *Amyone intermedia*, Herrick.
Fig. 11. do. one of the feet.
Fig. 12. *Bradya limicola*, Herrick.
Fig. 13. do. fifth foot.
Fig. 14. *Laoponte mississippiensis*, Herrick.
Fig. 15. do. fifth foot of semale.
Fig. 16. *Caligus americanus*, Dana and Herrick.

Plate II.

Fig. 1. *Pseudodiaptomus pelagicus*, fifth feet of male.
Eig. 2. do. fifth feet of female.
Fig. 3. do. opening of vulva.
Fig. 4. do. abdomen of male.
Fig. 5. do. one of the anterior feet.
Fig. 6. do. Spermatophore.
Fig. 7. do. antennule.
Fig. 8. do. antennule of male.
Fig. 9. *Temorella affinis*, Poppe, fifth feet.
Fig. 10. do. foot of fourth (?) pair.
Fig. 11. do. first foot.
Fig. 12. do. male antenna.
Fig. 13. *Corycœus subulatus*, Herrick, maxilliped.
Fig. 14. do. fourth foot.
Fig. 15. *Harpaticus chelifer*, Mueller, maxilliped.
Fig. 16. *Caligus americanus*, Dana and Her., labrum and maxilla.
Fig. 17. *Harpacticus chelifer.*
Fig. 18. *Laoponte mississippiensis*, Herrick, maxilliped.
Fig. 19. *Harpacticus chelifer*, Mueller, antennule.

Fig. 20. do. fifth foot.
Fig. 21 *Epischura fluviatilis*, Herrick, abdomen of male.
Fig. 22. do. fifth feet of female.
Fig. 23. do. fifth feet of male.
Fig. 24. do. one of swimming feer.
Fig. 25. *Simocephalus daphnoides*, Herrick.
Fig. 26. do. posterior margin of shell.
Fig. 27. do. upper angle of abdomen.
Fig. 28. do. portion of antennæ.

PLATE III.

Fig. 1. *Alona sp.* from Mobile Bay.
Fig. 2. *Pseudosida tridentata*. Herrick.
Fig. 3. do. antennule of female.
Fig. 4. do. post-abdomen.
Fig. 5, 6, do. first foot and maxilla.
Fig. 7. *Cypris perelegans*, Herrick, side view.
Fig. 8. do. seen from above.
æig. 9. do. appendages of labrum.
Fig. 10. do. jaw.
Fig. 11. do. abomen.
Fig. 12. do. natural size.
Fig. 13. *Moinodaphnia alabamensis*, Herrick.
Fig. 14. do. antennule.
Fig. 15. do. first foot.
Fig. 16. do. antennæ.
Fig. 17. do. post-abomen.

PLATE IV.

Fig. 1. *Cypridopsis vidua*. female from above. 1a, antenna, 1b, second antenna, 1c, first foot, 1d, second foot, 1e, mandible, 1f, maxilla of male, 1g, labrum from below.
Fig. 2. *Cypris minnesotensis*, female from side. 2a, anterior antenna, 2b, second antenna, 2c, first foot, 2d, second foot, 2e, mandible, 2h, caudal stylet.
Fig. 3. *Cypris striolata*, female from side, with portion of shell enlarged.
Fig. 4. *Notodromas monacha*, 4d, last foot, 4h, caudal stylet.
Fig. 5. *Cypris modesta*, male from side, 5*, female from side, 5a, anterior antenna, 5b, second antenna, 5c, first foot, 5h, caudal stylets, 5x, intromittant organ of male.
Fig. 6. *Cypridopsis hystrix*, side view of female, 6*, anterior and posterior margins enlarged, 6a, anterior antenna, 6b, second antenna, 6c, first foot, 6h, end of abdomen with second foot and stylets, 6y, lucid spots.
Fig. 7. *Cypris simplex*, outline of shell of female from the side, 7, from the side, 7*, from above, 7b, second antenna, 7d,h, stylets and second foot, 7p, edge of shell, 7y, lucid spots.

PLATE V.

Fig. 1. Larval shrimp, *Palæmonetes*, sp?
Fig. 2. *Gammarus mucronatus*, Say. a, mandible and palp, b, first foot, c, second foot.
Fig. 3. *Sesarmia* sp. (*reticulatus?*) a, right male chela, b, antenna, c, abdomen of male, d, abdomen of female, e, second abdominal foot of male.
Fig. 4. *Gelasimus vocator*, right chela of male, a, left chela.
Fig. 5. *Palæmonetes paludosus*, antennule, a, first cheliped, b, rostrum, c, second cheliped, d, same, e, one of abdominal feet, f. end of telson, g, first abdominal foot, h, last pair, i, setæ of same.
Fig. 6. *Penœus setiferus*.

Fig. 7. *Palæmonetss vulgaris.* a, antenna.
Fig. 8. *Mancasellus sp ?*
Fig. 8. Larval asellus ?

PLATE VI.

Fig. 1. *Gammarus dubius.* a, last abdominal foot, b, telson.
Fig. 2. *Streptocephalus sealii.* Head of male and female, a, antenna of young, b, same in advanced stage, c, part of abdomen of female.
Fig. 3. *Cypris virens*, labium and both pairs of maxillæ, a, second antennæ, b, first foot, c, second foot, d, jaw, e, caudal stylets.
Fig. 4. *Harpacticus chelifer*, a, antenna of male, b, fourth foot of female, c, fifth foot of male, d, maxilla, e, second foot of male, f, mandible, g, second maxilliped.
Fig. 5, *Laoponte mississippiensis*, abdomen, a, one of the feet.
Fig. 6, *Canthocamptus mobilensis*, a, caudal stylet of male, b, antenna of female, c, first foot, d, fifth foot of female, e, fifth foot of male, f, antennule.

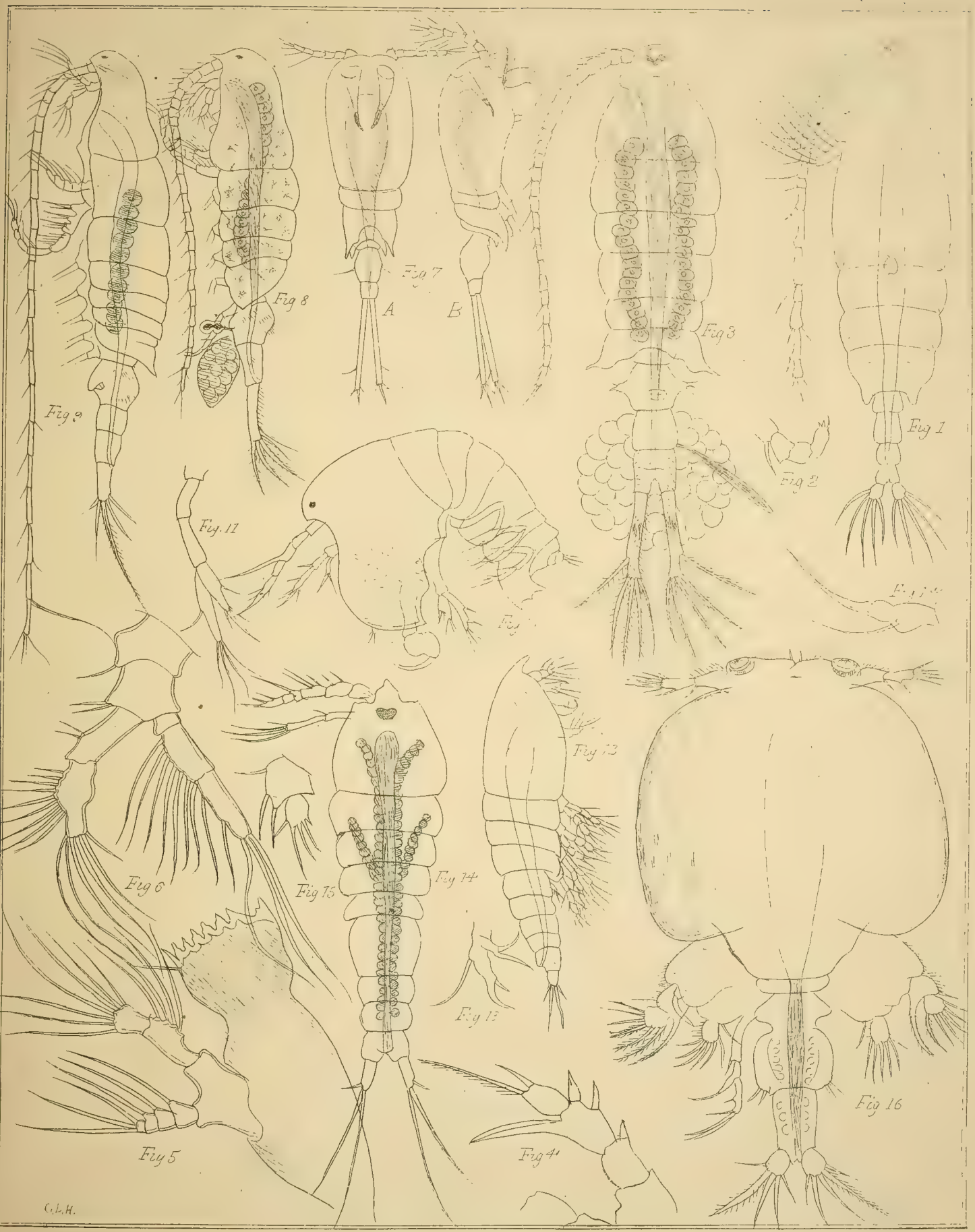
PLATE VII.

Fig. 1. *Cyclops simplex*, a, abdomen, b, labrum, c, antenna of female, d, fifth foot, e, pair of feet, f, pair of feet, g, pair of feet, h, antennule, i, mandible, i, maxilliped.
Fig. 2. *Cyclops fimbriatus*, a, part of abdomen, b, antenna, c, labrum, d, feet of fourth pair.
Fig. 3. *Cyclops diaphanus*, a, part of abdomen, b, pair of feet, c, antenna of female, d, labrum, e, spermatheca.

(PLATE VIII, omitted.)

PLATE IX.

Fig. 1. *Ilyocryptus spinifer*, Her., female.
Fig. 2. Post-abdomen of same.
Fig. 3. Antennule of same.
Fig. 4A. Jaw of *I. sordidus.*
Fig. 4. Post-abdomen of same.
Fig. 5. Post-abdomen of *I. agilis.*
Fig. 6. Head of same, antennæ being removed.
Fig. 7. Antennule of *I. sordidus.*
Fig. 8. Spines on edge of shell of same.
Fig. 9. Post-abdomen of *I. acutifrons.*
Fig. 10. *Monospilus dispar*, female.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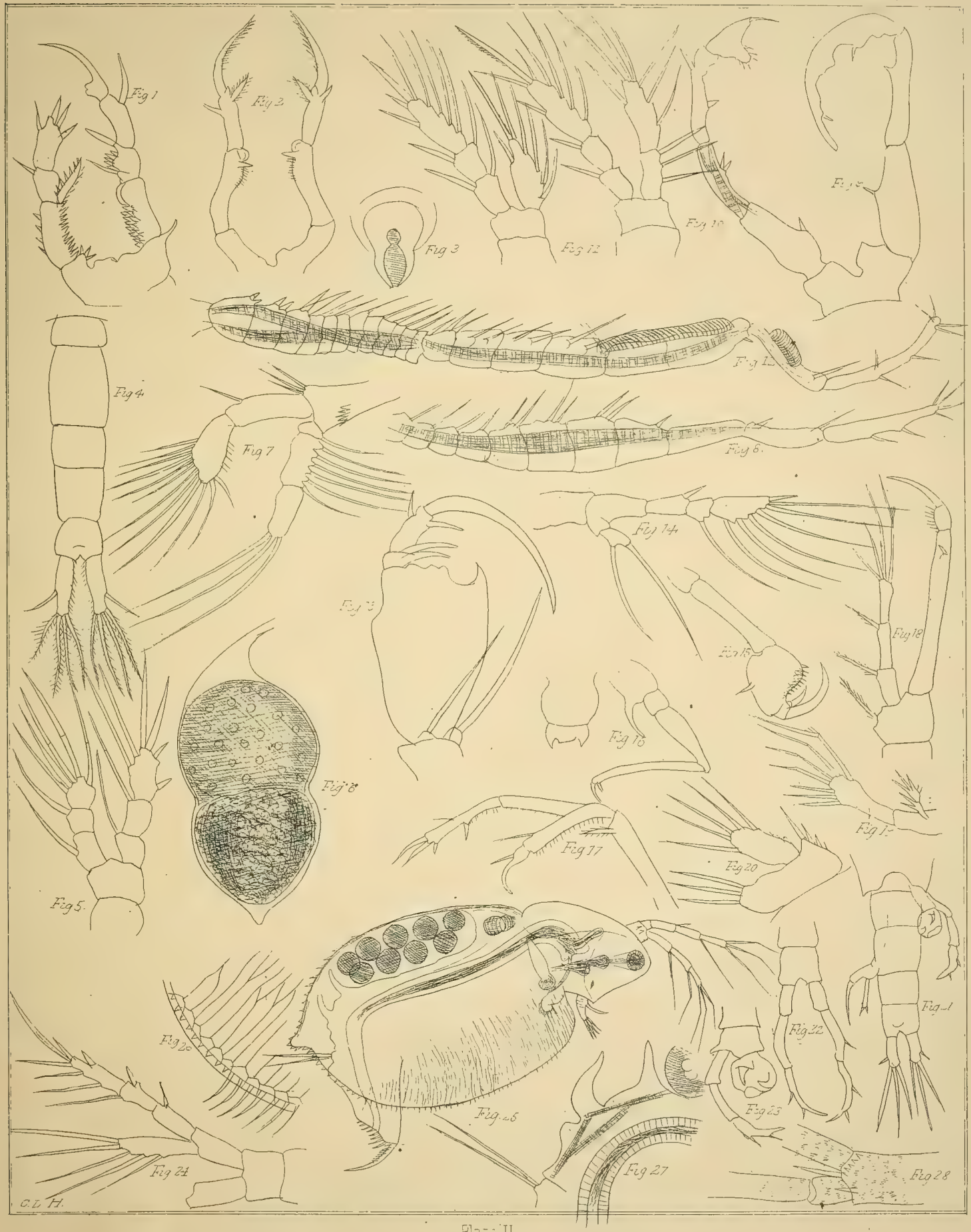
C.L.H.

Plate I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C. L. H.

Plate II.

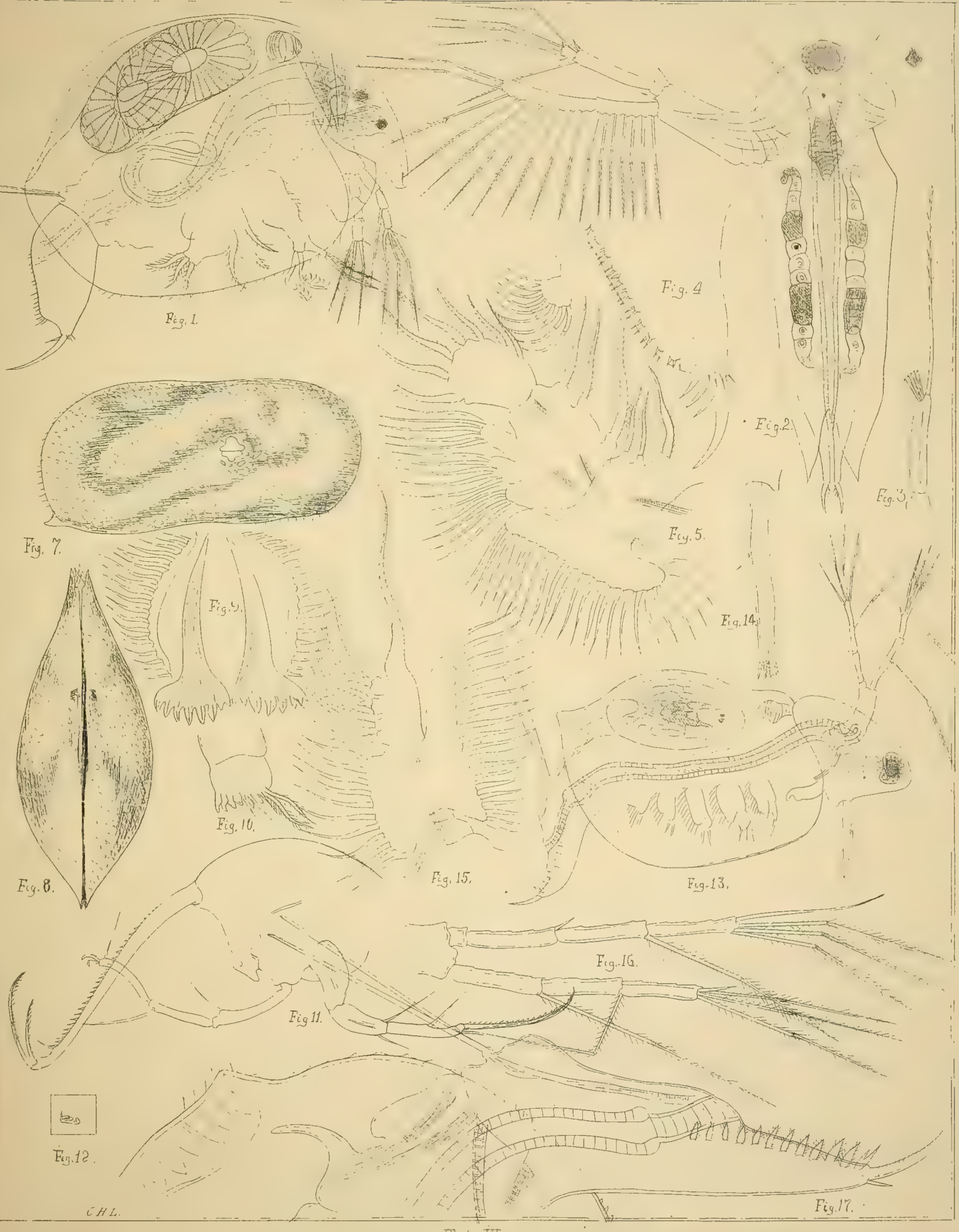

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Plate III.

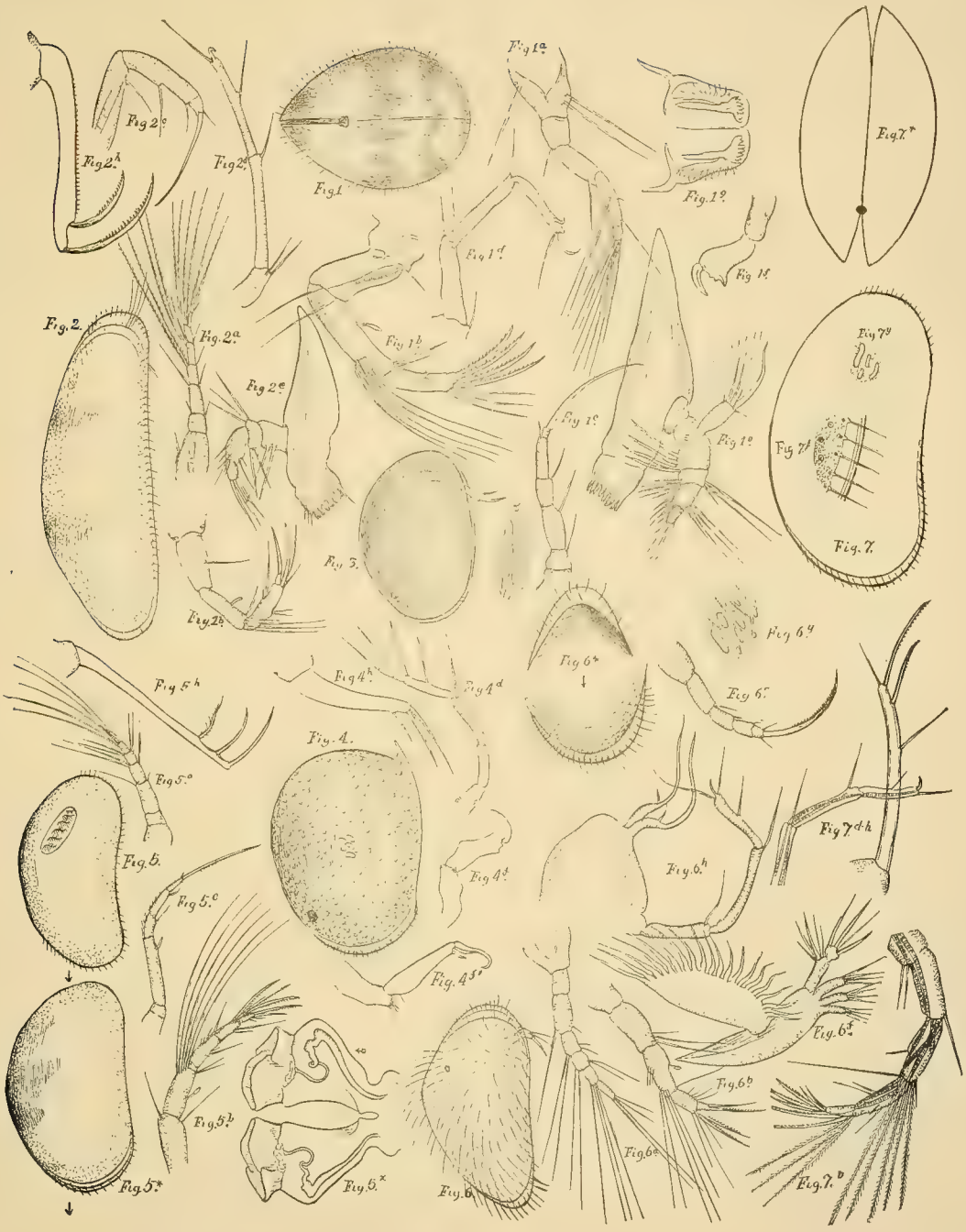
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Fig 3.
Fig 7a
Fig 7g
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Fig 7.
Fig 5h
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Fig 5.
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Fig 5x
Fig 4h
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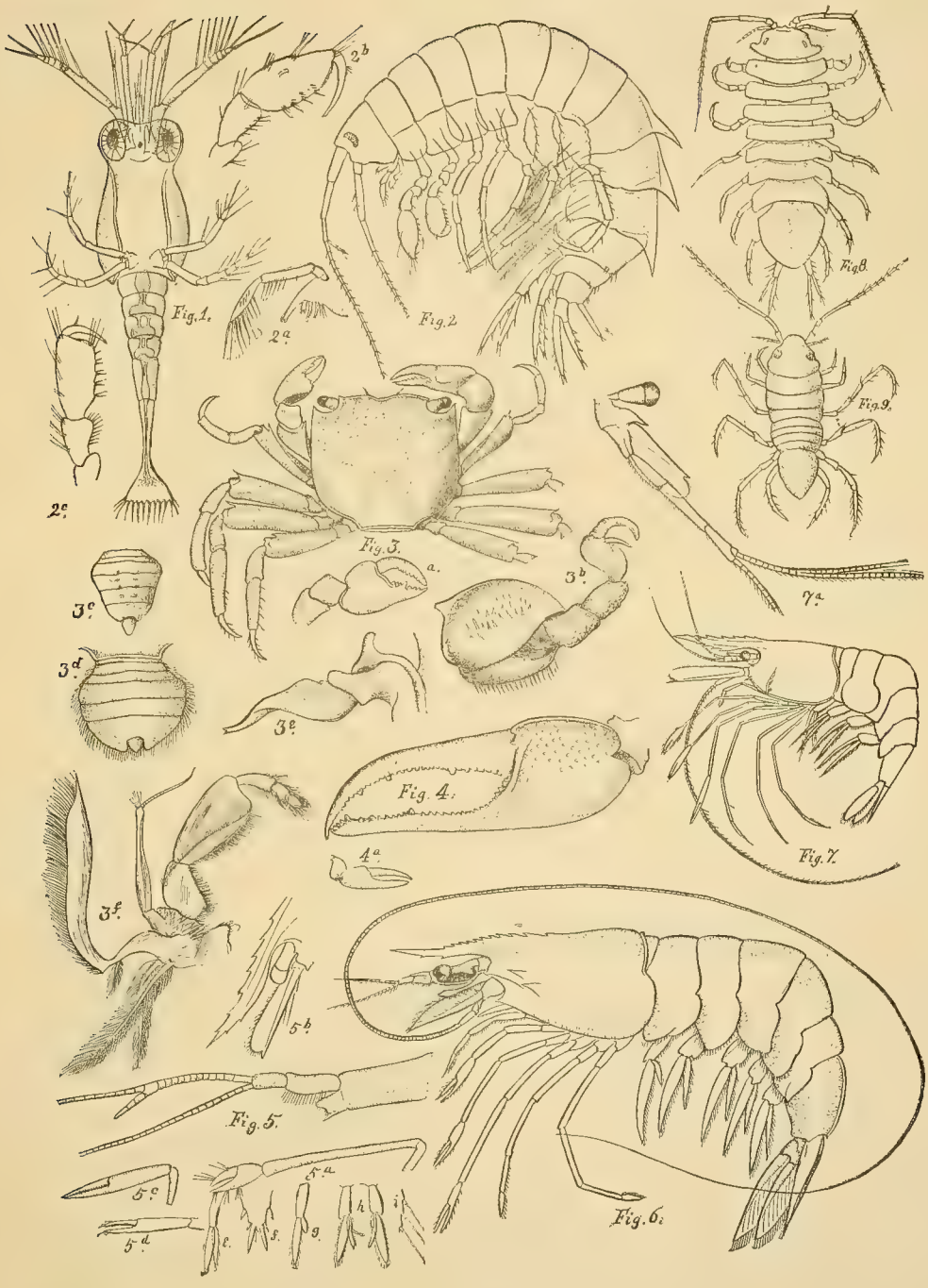
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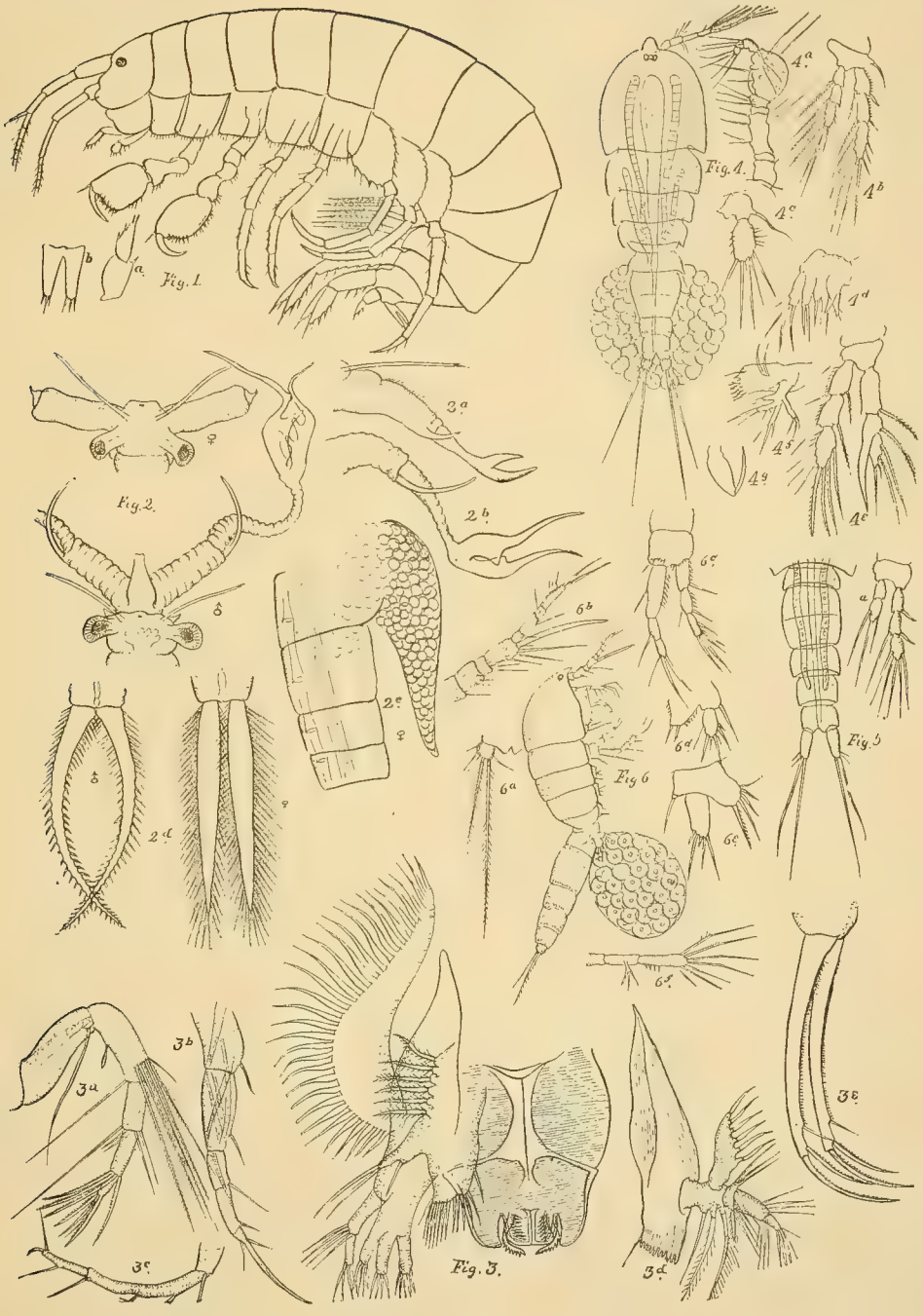
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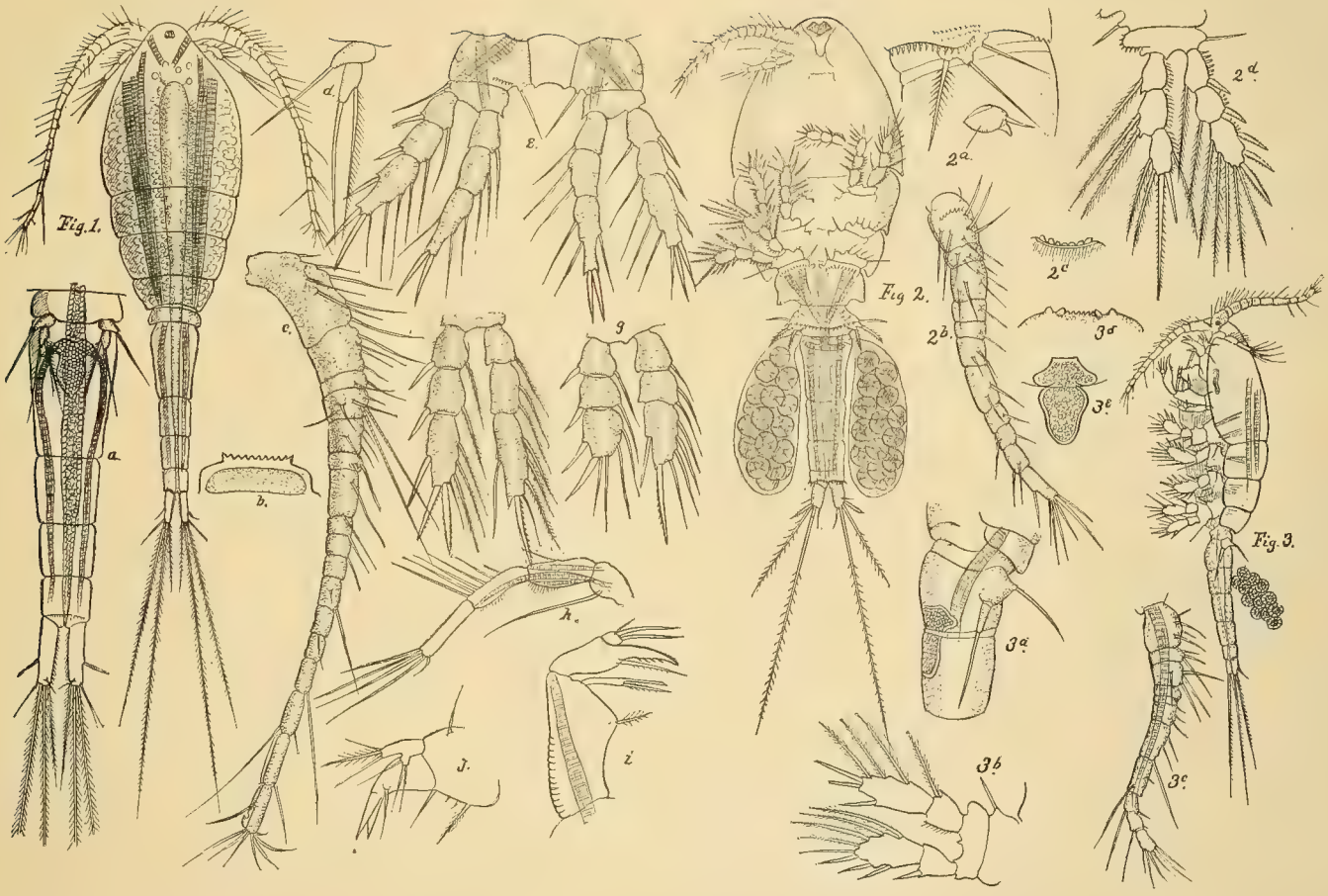
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3e.
Fig. 3.

C. L. Herrick.

Plate IX.